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Editorial Notes

Gas and the Nation

THE lecture which was delivered last week to the Royal Society of Arts by Mr. E. V. Evans, demonstrating in such lucid manner the important contribution of the Gas Industry to the national welfare—a contribution which we have said so many times merits far wider recognition—was a penetrating survey of the fuel problem and a fitting sequel to Sir David Milne-Watson's Address on national fuel policy given in October last. Those nations who find themselves in control of great fuel resources, remarked Mr. Evans, must regard themselves as trustees whose duty it is to ensure that these resources are utilized to the best possible advantage; and he went on to develop a powerful case that the rational plan would be to encourage the Gas Industry to supply the community's heat requirements, leaving the field of power for the expansion of the electricity industry. He pointed to the confused position which has arisen between the two industries—a degree of overlapping and competitive effort as a result of which public interest is already suffering. That portion of the domestic load which does not directly aim at the supply of heat can, with great national advantage, be taken by electricity, but national economy and the consumers' pockets are best served if the demands for heat are met by the products of the Gas Industry, gas and coke. The future may see these demands being met entirely by gas—the "incredibly cumbrous method" of the solid fuel fire being abolished. As an example of what is immediately possible, Mr. Evans cited the model dwellings at Kensal House, where a complete smokeless fuel service has been provided for the tenants at a cost actually less than that which the average working-class family has to pay for an old-fashioned smoke-producing system. The traditional argument that the coal range must be retained on the score of cheapness no longer holds.

Would it be a defensible proposition, asked Mr. Evans, to burn coal for the production of steam, to supply the steam to an engine, to cause the engine to turn a shaft, and then to apply a brake block to the shaft so that the friction between the brake block and the shaft might generate sufficient heat to warm one's home or office? Yet that in effect is what is done when the energy of coal is converted into electrical energy which is then used for heating purposes.

There is a widespread belief, which has received considerable Government backing, that the way to a fuel Utopia is along this tortuous path. In actual fact, as was emphasized by Sir David Milne-Watson, and again shown by Mr. Evans, it would be an economic disaster if the electricity industry were to cope with the nation's heat requirements. In regard to coal conservation by the carbonizing process, Mr. Evans put forward a most interesting argument. For domestic purposes, he pointed out, in effective efficiency 1 cwt. (15 therms) of coal is equivalent to 5 therms of gas or 0·89 cwt. of coke. Taking the thermal efficiency of the process as 77%, which is, of course, an established figure, on carbonization 1 ton (300 therms) of coal yields 75 therms of gas and 141 therms of coke available for sale. In use, the gas is able to replace 225 therms in coal and the coke to replace 176 therms in coal. By carbonization, therefore, we have obtained the equivalent of some 400 therms in place of the 300 with which we started—to say nothing of the tar and sulphate of ammonia. Had the raw coal been burnt directly, not only would one-third as much again have been required, but the atmosphere would have been polluted. In short, the carbonizing process results in thermal economy and social benefit. Turning to electricity, it may be accepted that, for domestic purposes, 100 units can replace 1 cwt. of coal. The thermal efficiency of electricity generation may be taken as 27%, and, allowing for transmission loss, the overall efficiency becomes 23%. Thus, what Mr. Evans termed the "raw coal equivalent" of electricity generation is 0·816 when the electricity is used as heat, comparing with a figure of 1·313 for carbonization. The difference between 30% economy and 20% loss, he pointed out, would represent the treatment of 10,000,000 tons of coal per annum more than is at present used in the Gas Industry if the same amount of domestic heating were achieved by electricity instead of gas.

Considering that in practice one therm of gas is equal to 20 units of electricity, and bearing in mind the advantages which the carbonizing process possesses, it may well be asked how it is that the electricity industry has been able to acquire any domestic heating load. The answer is that the electricity industry has been able to subsidize its heating load by the prices charged for current for lighting and it has in force tariffs of such a nature that if electricity is used extensively for heating it appears to cost little more than what is in fact a much cheaper commodity, gas. At 5d. a therm gas is half as expensive for heating as electricity at ½d. a unit; and the Gas Industry's reply to the electrical challenge lies, as we have so long insisted, in the general adoption of two-part or other attractive tariffs which will bring the commodity price of gas down to 5d. and less per therm.

After the B.I.F.

THE British Industries Fair ended on Friday last after its fortnight's run. At Birmingham, though there were fewer exhibitors—65 less than in 1937—the stand space occupied was 3,465 sq.ft. in excess of the previous year, constituting another record for Castle Bromwich. Once again the Gas Industry has supported the Fair well, and from the aspect of prestige it will be agreed that the display staged in the Gas Section was second to none. All who visited the Fair must have been impressed by the Gas Industry's showing. Never before have we seen a better gas display. Wider gangways—we have long advocated these—gave shape and distinction to individual exhibits which formerly were obscured by being too close together. Still further sectionalization would, we think, help, but certainly the arrangement of the stands this year was an advance on previous years.

All who visited the Fair, too, must have been struck with the extent of gas service in both home and industry and in the sphere of public lighting. More strikingly than ever before was the excellence of the finish of modern gas appliances brought out; the whole Section gave the impression of aliveness to modern requirements and also of unity of purpose—service to the consumer. By contrast the electrical section did not show the cohesion which characterized the gas display. Our Industry has developed a fine sense of showmanship, and too great praise cannot be given to the manufacturers of plant and appliances for their efforts. Material apparently unpromising from the point of view of display was shown in a surprisingly attractive way, while equipment in itself attractive in appearance was made doubly so by the skilful design and layout of the colourful stands conforming to the uniform scheme of the Gas Section. We do not intend at the moment to discuss the question of policy in the matter of Gas Industry participation in the Fair, about which, as is generally known, opinions differ; but we think the manufacturers who expended so much time, energy, and money on first-rate exhibits must have been gratified by the way in which the personnel of the Industry supported their encouraging endeavours. The Joint Gas Conference—which, by the way, was accorded little Press publicity—was well attended, and the lightness of the programme enabled time to be spent—as it obviously should be spent—in examination of the appliances exhibited, many of which were shown for the first time. The official visits of the Junior Gas Associations and the Salesmen were also marked by very large gatherings. More new developments, we think, were brought to notice at this year's Fair than on any previous occasion. The Section as a whole demonstrated how very much alive are the manufacturers and how well organized and equipped they are to effect improvements and to forward the cause of gas.

We described the individual exhibits in a Special B.I.F. Supplement in our issue for Feb. 16 prior to the Fair, and it is not our intention here to particularize. We may, however, count as an exception the extensive and comprehensive display staged by the British Gas Federation—a display more elaborate than hitherto and certainly most convincing. This was a very fine co-operative effort, demonstrating the fineness of control which can so readily be exercised in the application of gas to industrial furnace work. Many new instruments and appliances were shown on this stand for the first time, and the display as a whole was most impressive. Not a great deal of domestic gas lighting equipment was on show, but the fittings exhibited were outstanding in their attractiveness, and in design in keeping with modern ideas fell no way behind the lighting fittings shown by the electrical industry. New cookers, new fires, new flueless heaters of most pleasing design, and an imposing array of new water heaters were on view; and it must be agreed that if the Gas Industry fails to retain its present place in the home and capture a vastly greater volume of business it will not be the fault of the appliance makers. The Gas Section display at the B.I.F. this year must have proved a source of encouragement to the personnel of the Gas Industry and a stimulus to further confident effort. No better indication of the enterprise and go-ahead policy of the manufacturers of gas plant and appliances could have been given.

Hire Purchase Bill

THE Committee stage of this Bill has now been concluded, and the amendments which have been made by the Committee have entirely transformed the Bill. As it was originally drafted, a hirer who had paid one-third of the hire-purchase price could appeal to the County Court against any attempt by the owner to recover possession of the goods. In its present form the Bill would render it illegal for an owner to recover possession of goods in respect of which one-third of the hire-purchase price had been paid, unless an order was obtained from the County Court. Moreover, the Bill is to apply to all hire-purchase contracts involving goods of a value of less than £100.

The amendment which had been put down in order to exempt the hire-purchase contracts of public utility undertakers from the Bill was rejected by the Committee on a division. It is disappointing that Miss Wilkinson, who on the first day of the Committee had accepted the principle of exemption for public utilities, should so suddenly have changed her mind. "I want to ask the Committee," she said, "whether a gas cooker as supplied by a public authority is on any different footing from a gas cooker supplied by anyone else."

The correct answer was supplied by Lieut.-Colonel Sir Walter Smiles in these terms: "The primary object of these public utility companies is to sell their gas, water, or electricity, and the only reason why they supply gas stoves, refrigerators, or other appliances is in order to get rid of their products." That fact alone is sufficient to rebut any suggestion, if such a suggestion there be, that public utilities are anxious to snatch back hire-purchase appliances. Whatever inducements the snatch back system may offer to the ordinary trader, public utilities have every interest in retaining upon their consumers' premises the means whereby those consumers use their main commodity. Colonel Ponsonby cited a telling example of a gas company which, in the year 1937, had been forced to recover possession of only 0·24% of the total amount of appliances let out on hire-purchase terms. Miss Wilkinson gave some promise to reconsider the question of installation charges, although she was extremely vague with regard to this important question.

It is impossible to foretell what the attitude of the House of Commons to this Bill will be when it returns for Report and Third Reading in a form so different from that in which it left the House. There is a general feeling that a great deal of further revision will be necessary if the Bill is to pass into law. In particular the position of the public utilities will have to be reconsidered if the poorest section of the community is not to suffer. Gas is a primary necessity of modern life, and Parliament has intended that no impediment shall be placed in the way of providing a cheap and efficient supply to all sections of the community. It is entirely outside the scope of such a Bill as the Hire Purchase Bill to render the method of giving that supply—against which no abuses can be cited—more difficult.

The Price of Capital

Going through the Gas Company reports for the past year, one finds reference by Directors in a number of cases—as well as by Chairmen in their Addresses to proprietors—to issues of capital made during the twelve months. This is hardly to be wondered at. Capital expenditure is always being incurred, in greater or less degree, by gas undertakings, to meet the demands of new and existing consumers who require appliances for their satisfaction to-day which were unheard of only a few years ago. In addition, too, to fresh capital, there have been opportunities for redeeming debenture stock with the proceeds of new issues at lower rates of interest. Last year was an exceptionally favourable time for financial operations of this character, and those who felt the necessity, and found themselves able, to take advantage of it may justly regard themselves as entitled to congratulation. There may be many further favourable opportunities, but, in the matter of interest rates, the position to-day is not quite the same as it was twelve months ago. It is true that we are now rapidly approaching the "big jump"—the Budget—and that thereafter the going may be smoother, but, so far as the price of capital is concerned, would it be surprising to some people if, in the event, those who satisfied their requirements during 1937 came to regard themselves as entitled to an even fuller measure of congratulation than they look upon as their due to-day? Falling prices in the Stock Markets are day by day widening the lists of stocks available to investors who cannot get along with an unduly low return upon their capital.

A Startling Judgment

Whatever may be the strictly legal position, we cannot help regarding the judgment of Mr. Justice Hilbery given at the Newcastle Assizes with some trepidation. As we understand the case, gas had escaped from a main and had blown up a house. The reason for the escape was that mining operations had been conducted beneath the gas main which was thereby deprived of the necessary support. The Gas Company were held to be liable for the damage, and it emerged that they had no redress against the Colliery Company.

It was apparently not suggested that the Gas Company had been negligent, for it was accepted that they could not have ascertained that there was a leak of gas until the gas had penetrated the soil and had caused the damage. They were no doubt held liable on the ground of nuisance, but a mere layman might have been forgiven for assuming that the nuisance had been caused by the Colliery Company. Whatever the law may be on the subject, it is obviously an absurdity that Parliament should confer upon companies a right to lay their mains, and that a third party should be allowed, without let or hindrance, to deprive those mains of support.

No. 10, Downing Street

In our time we have been on many unusual journeys with Mr. T. F. C. Potterton, of the famous firm of heating engineers. He has, for example, shown us jobs which, "for reasons of State," are not appropriate matter for news articles. Among others which there has been no need to shield from the light of the publicity of our columns we might mention an expedition backstage of a London revue, where a water tableau included a warm fountain for the bathing belles. We have been privileged to take a peep into the luxurious *salons* of Elizabeth Arden, the beauty treatment specialists in Bond Street—premises dedicated solely to the service of womankind and bearing, so far as the mere male is concerned, all the sanctity of a convent. We have stood entranced at the splendour of a private swimming pool in an Arcadian setting amidst the woods of Highgate Hill. We have journeyed into the heart of the country to see an old-world cottage modernized with gas central heating; we have inspected similar equipment in the stately mansion and the modern flat; and, to bring us back to earth, we have seen the mundane, but no less important, applications of gas in the heating of office buildings. But of all these and many more, the visit we paid the other day to the Prime Minister's House at No. 10, Downing Street proved, perhaps, the most interesting of all—for there can be few houses in the country, indeed, in the whole Empire, which make a greater claim upon the imagination of the public than this unpretentious building within the walls of which world history has been made. On later pages of this issue we are enabled to describe the up-to-date central heating and hot water supply system which has lately been installed in the house around which the government of the country revolves. Our visit included a complete tour of No. 10, not forgetting the Cabinet Room itself and the private and "State" apartments. This is, indeed, an installation of which the Gas Industry may well be proud.

Lighting and Heating

In a Paper at a joint meeting of the Illuminating Engineering Society and the Institution of Heating and Ventilating Engineers last week Mr. F. C. Smith, of the Gas Light and Coke Company, showed how closely related are many of the problems of the illuminating engineer and the heating and ventilating engineer. He pointed, for example, to the growing use of high temperature radiant panels heated by gas. Care is necessary in the layout of installations incorporating these units to secure an even distribution of the thermal radiation, and for this reason heating engineers are now employing distribution diagrams similar in all respects to those used by the illuminating engineer. Again, Mr. Smith put forward two instances indicating the order of the contribution the lighting installation can make to the heating requirements. One of the cases considered was a single floor factory of area 10,000 sq.ft. where the heating requirements were met by radiant panel heaters maintaining an air temperature of 50°-55° F., this temperature, of course, being supported by thermal radiation from local sources suitably disposed. If the lighting installation consisted of gas units filled with enamelled shades complying with Home Office recommendations, then, with an illumination level of 5 foot-candles at the working plane, the lighting would contribute 30% of the heating requirements; while with an illumination level of 15 foot-candles its contribution would amount to 90% of the heat requirements. Fairly uniform distribution is the requirement in general for both the lighting and the heating, and the proportion of heat by convection and radiation for both the heating and lighting units is of the same order, and, in consequence, the desirable proportionality between these two components is not likely to be affected in a measurable degree when the heating system is supported by the heat from the lighting system. Moreover, the distribution of radiant heat is unlikely to be materially affected when both agents are operated simultaneously. The example given by Mr. Smith shows the desirability of controlling the heating system, and when gas is employed this control can be exercised effectively by thermostatic devices.

Letter to the Editor

Salaries of Gas Engineers

SIR,—The letter by "CALCULATOR" in this week's "JOURNAL" shows that he has entirely missed my point or at least failed to appreciate it.

I reiterate and again stress the importance of the fact that unless the Gas Industry *enforces* an adequate minimum scale to be adopted the whole scheme would be hopeless. You might as well "cry for the moon."

I have suggested a way of *enforcing* it. Can "CALCULATOR" suggest a better way? I am not taking Mr. Shapley or anyone to task. I congratulate him. I am giving them the benefit of past experience with a constructive suggestion or two; we want others.

I for one would not go cap in hand, "Please Mr. Councillor will you pay this scale?" Some hopes!

"DARE LUCEM."

March 2, 1938.

Institute of Fuel Meetings

Development of By-Product Coking

A meeting of the Institute of Fuel will be held at 39, Victoria Street, S.W. 1, on March 17 at 6 p.m., when a Paper will be presented by Mr. G. W. J. Bradley and Dr. G. E. Foxwell entitled "The Development of By-Product Coking."

On March 31 a meeting of the Institute will be held at the Institution of Mechanical Engineers, Storey's Gate, S.W. 1, at 6 p.m., when a Paper will be presented by Dr. S. Livingston Smith and Dr. C. H. Lander, C.B.E., entitled "A Comparison of the Cost of Heat Supply by Electrode Boiler or by Coke Boiler to the Same Group of Buildings," which will be followed by a discussion. The members of the Institution of Electrical Engineers, of The Institution of Gas Engineers, and of the Institution of Heating and Ventilating Engineers are invited to be present.

Advance copies of the above Papers can be obtained from the Secretary, the Institute of Fuel, 53, Victoria Street, S.W. 1.

Personal

Mr. A. D. HILL has been appointed Engineer and Manager of the Swadlincote Urban District Council Gas Department in succession to Mr. C. H. Taylor. Mr. Hill was previously with the Oxford and District Gas Company.

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Mr. F. G. BOWNESS, Engineer and Manager of the Maryport Gas Department, has been appointed Engineer and Manager of the Ripon Gas Department in succession to Mr. J. W. ROBERTS, who has been appointed to a similar position under the Padiham Urban Council.

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Mr. JAMES RILEY, Manager and Secretary of the Rossendale Gas Company, is to retire this month and he will be succeeded by Mr. R. Crowther, who will control the amalgamated Ramsbottom and Cloughfold Companies. Mr. Crowther is Engineer and Manager of the Ramsbottom Gas Company. Rossendale and Ramsbottom are both Subsidiaries of the United Kingdom Gas Corporation, Ltd.

Obituary

The death has taken place of Mr. FREDERICK SCHOFFIELD, a Director and former Chairman of the Morpeth Gas Company. He was 86 years old and was Mayor of Morpeth nearly 40 years ago.

Amalgamation and Grouping

Huddersfield, Honley, Holmfirth, and New Mill.

The Huddersfield Town Council on March 2 approved an agreement for the purchase of the Undertakings of the Honley U.D.C. Gas Department and the Holmfirth and New Mill Gas Light Companies.

When the necessary powers have been obtained, it is intended to supply the three undertakings with gas from Huddersfield.

Factories Act, 1937

Inspection of Gasholders

We are informed that arrangements have been completed on behalf of the South Eastern Gas Corporation for the inspection under the Factories Act, 1937, of all gasholders of the Undertakings controlled by the Corporation, through their Brokers, Messrs. Robert Crawford & Co., Ltd., with the British Engine, Boiler and Electrical Insurance Company, Ltd.

We learn also that the same Brokers have arranged with the British Engine, Boiler and Electrical Insurance Company, Ltd., inspection and insurance on behalf of the United Kingdom Gas Corporation, Ltd., and the Caledonian Gas Corporation, Ltd., in respect of all of the holders of the Undertakings controlled by those two Corporations.

Bafflers for Gas Appliances

New B.S. Specification

A British Standard has just been issued entitled "Bafflers or Draught Diverters on Gas Appliances, including Recommendations for Flue Terminals" (B.S. No. 766), which deals with the performance of bafflers on gas appliances and includes recommendations for flue terminals. The specification includes tests to determine the resistance, corrosion, and the strength of the baffler primary and secondary to the products of combustion.

The performance of a terminal is so dependent on the situation in which it is fitted—especially on the proximity or otherwise of buildings or parts of buildings, trees, &c.—and on the winds to which it is exposed (which factors are usually beyond the control of the person installing the terminal) that it is not considered practicable to specify exactly what the performance of a terminal should be, especially when the terminal is designed for use in unfavourable conditions and may therefore embody features not necessarily advantageous in the more favourable exposed positions. The tests proposed are thus of a simpler nature than is necessary to determine completely the performance of the terminal, and may pass terminals which in practice may be unsatisfactory under certain conditions.

While a baffler fitted to one gas appliance will work satisfactorily, it is known that the same baffler on a different gas appliance may be unsatisfactory. It has been found impossible to prove that any particular baffler is in itself universally satisfactory, but only that in a stated arrangement in conjunction with a stated gas appliance it fulfils its proper purpose.

Copies of this new British Standard No. 766-1938 may be had from the British Standards Institution, 28, Victoria Street, London, S.W. 1. Price 2s. each (2s. 2d. post free).

Forthcoming Engagements

March

12.—**Scottish Juniors.**—Joint Visit to Works and Showrooms at Alloa.
14.—**L.C.C.A.**—Technical Committee, 2.30 p.m.
15.—**I.G.E.**—Gas Education Executive Committee, 2.30 p.m.
15.—**London and Southern Juniors.**—Meeting and Paper by C. H. Ward on "Coke Conveyors."
16.—**B.C.G.A.**—Executive Committee Meeting, 11.30 a.m.
17.—**I.G.E.**—Refractory Materials Joint Committee, 2.30 p.m.
17.—**Southern Association (Western District).**—Commercial Meeting, Rougement Hotel, Exeter, 2.30 p.m.
18.—**Manchester Association.**—Annual Meeting, Midland Hotel, Manchester. Presidential Address of E. Astbury.
19.—**Wales and Mon. Juniors.**—Visit to Neath.
21.—**L.C.C.A.**—Finance Committee, 10.45 a.m.; Executive Committee, 11.15 a.m.; Central Committee, 2.30 p.m.
24.—**Midland Association.**—Annual General Meeting, Grand Hotel, Birmingham.
23.—**London and Southern Juniors.**—Visit to G. A. Harvey & Co., Greenwich Metal Works.
25.—**Southern Association.**—Annual General Meeting, Hotel Victoria, W.C. 2, 2.30 p.m.
26.—**Western Juniors.**—Visit to Bridgwater. Question Box.
26.—**Yorkshire Juniors.**—Meeting at Bradford. Paper by A. Pickard on "The Technical Control of a Small Undertaking."
26.—**Scottish Western Juniors.**—Annual Busineess Meeting at Glasgow Corporation Lighting Department. Paper by W. Rae, of Electrolux, Ltd., on "Domestic Refrigeration."
29.—**B.C.G.A.**—Eastern District Conference at Cambridge.
29.—**Gas Coke Export Association.**—Committee Meeting, 11 a.m.; Annual General Meeting, 12.15 p.m., at Gas Industry House.
29.—**Southern Association (Eastern District).**—Meeting at Gas Industry House, 2.30 p.m.
31.—**S.B.G.I.**—Council Meeting, 2.30 p.m.

April

1.—**I.G.E.**—Liquor Effluents and Ammonia Committee, 11.15 a.m.; Joint Research Committee, 2.30 p.m.
2.—**Scottish Eastern Juniors.**—Visit to Aitken Colliery. Paper by G. Jenkins on "Coal Analysis."
7.—**I.G.E.**—Joint Committee on Complete Gasification under Pressure, Fuel Research Station, S.E. 10, 11 a.m.
7.—**Midland Juniors.**—Meeting and Paper by W. L. Howe, of Nottingham, on "Gas and Filtration and Heating of Swimming Pools."
8.—**North British Association.**—Spring Meeting at Coatbridge.
9.—**Manchester and District Juniors.**—Annual Dinner. Paper by W. Hodkinson on "Technical Work in a Holding Company."
23.—**Western Juniors.**—Annual Meeting at Swindon. Presidential Address by J. E. Akroyd.
23.—**Midland Juniors.**—Visit to Central Laboratories and Automatic Water Gas Plant, Nechells Gas-Works, Birmingham.
23.—**Yorkshire Juniors.**—Meeting at Leeds. Paper by G. F. Murray, of Sheffield, on "Water Heating by Gas."

Stoke-on-Trent and Coke Oven Gas

At a recent meeting of the Stoke-on-Trent City Council on Thursday last, proposals to take supplies of gas from the Birchenwood Coal and Coke Company and from the Shelton Iron, Steel, and Coal Company were discussed.

In moving the adoption of the Gas Committee's report, which recommended that approval be given to agreements for the supplies—for a period of 21 years in the case of the Birchenwood Company and providing for a supply up to a maximum of 12 million cu.ft. per day from the Shelton Company, Mr. A. E. Hewitt said he would like the Council to understand that the Shelton Company were not prepared to guarantee more than 5 million cu.ft. per day; whatever they supplied over that amount must be subject to their own requirements. As for 12 million cu.ft. the Company were only prepared to provide that after they had taken all they themselves wanted and would not definitely guarantee 12 million cu.ft.

Alderman W. A. Holdcroft moved an amendment which he said was designed to limit the Corporation to taking gas from its own Gas-Works and the Shelton Company. He also added that it was in the ratepayers' interests that their own gas-works should be kept up.

In reply to the discussion, Mr. Hewitt denied that there was any question of destroying municipal enterprise, pointing out that they were to spend £60,000 this year on their Gas-Works, and said they were doing that in the interests of the ratepayers and consumers. Were the Council going to weigh in the balance 50 or 60 men who might be stopped against the interests of 69,000 consumers? he asked.

The proposals were approved.

News of the Week

Powers to Borrow £15,000 for expenditure on street lighting by gas during the three years next ensuing is being sought by the St. Helens Corporation.

The Price of Gas at Hartlepool has been increased owing to increased costs of coal and materials. This year the Company are facing an expenditure on coal of £6,000 more than last year.

Mr. B. P. Bezant, Engineer-in-Charge of Tonbridge Gas-Works, gave some interesting information on conditions of employment in the course of a recent talk to the Tonbridge Chamber of Trade.

We Have Received from the British Chemical Plant Manufacturers' Association a copy of their 1938 Edition of the Official Directory, which is issued gratis to those interested in the purchase of chemical plant.

Application for a Special Order under the Gas Undertakings Acts, 1920 to 1934, is intended to be made to the Board of Trade by the British Gas Light Company in respect of their Fenny Stratford Undertaking.

Applications Are Invited by the Maryport U.D.C. for the position of Engineer and Manager. The commencing salary is £320, rising to £350. Further particulars will be found in our advertisement columns.

With the Object, *inter alia,* of empowering the Company to supply gas within certain specified areas, the Sileby Gas Light and Coke Company intend to apply to the Board of Trade for a Special Order under the Gas Undertakings Acts, 1920 to 1934.

There Are 1,759 Street Lamps, of which 1,698 are gas and 61 electric, in Nelson. Altogether there are 1,333 lamps in main streets and 426 in back streets. It is claimed there are few towns in the North that have so many lamps in relation to the size.

Under the Auspices of the Local Government Committee of the Edinburgh Women Citizens' Association, Mr. A. B. Munro, Sales Superintendent, Edinburgh Gas Department, gave an Address on various aspects of the sales side of the Industry on March 5.

A Change of Calorific Value of the gas supplied by the Altrincham Gas Company will take effect on June 1 when the declared figure will be 475 B.Th.U. per cu.ft., except in the parishes of Carrington and Partington in the rural district of Bucklow, where the value will continue to be 450 B.Th.U. per cu.ft.

An Extension of Loughborough Gas-Works, involving the construction of a new holder, was forecast by the Mayor (Alderman A. Lacey) in his speech at a recent dinner of the Corporation Gas Department. He also referred to the increasing demands upon the Undertaking, concerning which he gave detailed figures.

An Increase in the consumption of gas during January of over 3 million cu.ft., as compared with the corresponding month of last year, was reported at a meeting of Plymouth Corporation Gas Committee on March 3. The price of gas, there is reason to believe, will remain at that figure during the next twelve months.

A Reduction of Hire-Purchase Terms for gas cookers and other domestic appliances have been agreed to by the Dewsbury Gas Committee, following a finance report by the Borough Treasurer and the Gas Engineer and Manager, Mr. H. L. Bateman. The Committee proposes to spend some £6,000 on new meters in the district.

Copies of the Proceedings of the XIIth International Congress of Acetylene, Oxy-Acetylene Welding, and Allied Industries, London, 1936, containing the latest information concerning the oxy-acetylene process, can be obtained at a cost of £1 1s. for the first set and 15s. each subsequent set, instead of the normal price of £2 2s., on application to the Secretary, The Institution of Gas Engineers, 1, Grosvenor Place, S.W. 1.

Members of The Institution of Gas Engineers will be welcome at a meeting of the Institute of Fuel on Thursday, March 31, at 6 p.m., at the Institution of Mechanical Engineers, Storey's Gate, S.W. 1, when a Paper will be given by Dr. S. Livingstone Smith and Professor C. H. Lander on "A Comparison of the Cost of Heat Supply by Electrode Boiler or by Coke Boiler to the same Group of Buildings." Advance copies of the Paper can be obtained from the Secretary, The Institution of Gas Engineers, 1, Grosvenor Place, S.W. 1.

An Engineer and Manager is required at Stockton-on-Tees. Full particulars of the position, which carries a commencing salary of £700 per annum, rising to £800, will be found in our advertisement columns.

An Address to the Jersey Rotary Club was delivered by Mr. R. A. Fuller, Secretary of the Jersey Gas Light Company, on Feb. 24. Mr. Fuller took as his subject "Some Reflections on the Gas Industry." During the course of his remarks, he drew attention to the fact that the Jersey Company was the first in the Channel Islands to supply gas. That was in 1831, and to-day the Company was the largest ratepayer in Jersey.

The Foire de Paris will be held from May 21 to June 6. The fair was founded in 1904 and, in little over 30 years, has become one of the greatest commercial markets in the world. In size and scope, it is stated to be unequalled throughout Europe. Two million visitors, of whom forty thousand are foreign buyers, visit the fair each year. A *carte de legitimation* may be obtained from the office of the Foire de Paris, 17, Tothill Street, Westminster, S.W. 1.

The Opposition of the Canterbury City Council to the Canterbury Gas and Water Company's Bill was referred to at a special meeting of the Company, when the Chairman, Mr. Silas Williamson, J.P., revealed that the Council had insisted on a provision enabling them to purchase the Undertaking. He said that unless the proposal to purchase was dropped no discussion on other matters was possible and the matter would have to be contested before the House of Commons. A resolution approving the Bill was passed unanimously.

The Annual Dinner of the Fuel Department of Leeds University, a pleasant informal function, had special significance this year in view of the pending retirement of Professor J. W. Cobb from the Livesey Chair. The guest of the evening—the dinner was held on Friday last—was Mr. T. F. E. Rhead, Chief Chemist to the Birmingham Gas Department, who proposed the only toast, that of the Fuel Department. Reply to the toast was made on behalf of the staff by Mr. H. J. Hodsman; Dr. H. S. Houldsworth and Mr. J. H. Dyde, Engineer and General Manager to the North Middlesex Gas Company, responded for the old students; and Mr. H. Taylor spoke for the present students. Eloquent tribute was paid to the work and influence of Professor Cobb during his occupancy of the Livesey Chair.

The General Discussion on Lubrication and Lubricants which took place in October at the Institution of Mechanical Engineers will very shortly be available in two bound volumes, comprising some 1,200 pages, at a charge of 25s. per set, post free. As our readers are probably aware, some 29 British and 22 foreign societies agreed to collaborate and, as a result, 136 Papers were received. The Papers dealt with the major problems of the subject, practical and theoretical and the correlation of these aspects, the application of bearing design, the relationship of academic research and trade practice, statements of current views on bearing metals, and the significance of laboratory tests, including wear and friction tests. The Papers, together with the summaries by the reporters, the accounts of the discussions, and the collated replies by the Authors, constitute an invaluable compendium of current information on lubrication.

"Boiler Bothers Abolished"

Overheard in any home—"Some women manage to run a hot water service *properly*."—"Some husbands *sometimes* remember to bank up the boiler at night." Without delving further into the family row which is obviously brewing, we would just select that short extract from the advertisement which heralds the latest campaign by the Gas Light and Coke Company on behalf of the small domestic gas-fired boiler.

The campaign, which is directed towards taking advantage of "half-price gas" under the Company's two-part tariff, is supported by the usual high standard of publicity, which makes good play of pictorial comparison between ordering, storing, stoking, raking, and ash removal involved in the use of solid fuel boilers and the neat, automatic, and trouble-free service provided by the "Ideal" gas boiler which can be hired for 1s. per week. *The biggest bargain in labour-saving home service that even Mr. Therm has ever offered* is a caption which should make a ready appeal to all who want to lessen the work and worries of household management—and who doesn't?

Stretford's New Gas Showrooms

Attractive new gas showrooms were officially opened for the Stretford and District Gas Board on Feb. 14 by the Mayor of Stretford (Alderman T. Spackman) in the presence of a representative gathering of Councillors from the Stretford, Sale, and Urmston districts.

The new building consists of a two storey fire-proof structure, designed on modern lines. The ground floor is utilized for the main showroom, and on both sides of the ground floor movable wall panels have been installed in order that the display of fittings can be changed periodically, and the whole scheme of decoration can be altered at very little cost. The space behind the panels and the outer main walls have been utilized for the accommodation of flues, gas points, water, and other services. The remainder of the ground floor is occupied by showroom offices, boiler house, accommodating the "Ideal" central heating unit, and stores receiving department at the back of the building. On the first floor accommodation is provided for a large Demonstration Hall to seat 200, and consists of lecture platform, fully equipped with kitchen cabinets, and the necessary gas appliances. A sound picture apparatus has been installed for use in connexion with the lectures and gas publicity and other general topical films. The remainder of the first floor is occupied by offices and the Home Demonstration Kitchen which is fully equipped with modern appliances.

The building is heated by low-pressure hot water system, and a mechanical system of ventilation is provided. A simple scheme of decoration has been adopted in order that suitable backgrounds can be obtained for displaying gas appliances.

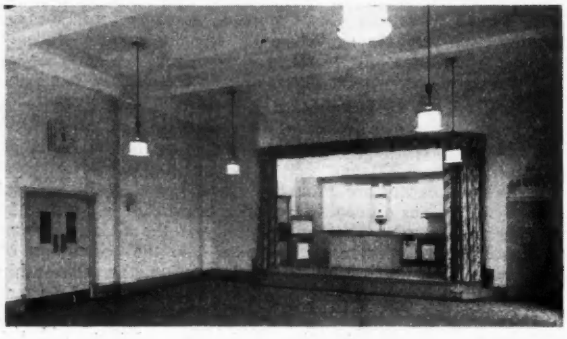
The Architect for the Showrooms was Mr. H. T. Seward, F.R.I.B.A., 16, Princess Street, Manchester.

In declaring the new Showrooms open, the Mayor remarked that the layout and construction of the building reflected credit on all concerned. Since 1922 great progress had been made. The capacity of the Board's plant was then 3 million cu.ft. per day, but by modernization and enlargement the maximum output was now 4¾ million cu.ft. per day, and this in face of a serious coal stoppage in 1926.

An industrial gas section was formed in 1927, and much work of an intensive nature was necessary before the larger industrial consumers could be brought in the scheme to use gas as a fuel. Now the industrial load had been increased to 581 million cu.ft. per annum. In 1922 the total number of consumers was 14,000 at end of March last year it was 30,764. The two-part tariff had been taken advantage of by some 7,000 domestic consumers.

Councillor R. Hall, J.P., moved a vote of thanks to the Mayor, which was seconded by the Mayor of Sale, Alderman J. W. Slate.

Councillor W. P. Jackson, Chairman of Manchester Gas Committee, said they were all very pleased to see such a magnificent building and he wished it every possible success.



The Demonstration Hall.

The Main Showroom.

Cannel and Oil Production

The potentialities of the Lothians and Fife coalfields to supply cannel for the production of oil were indicated by Mr. J. Jamieson, Engineer and Manager of Edinburgh Gas Department, in a Paper read to the Royal Society of Arts, Edinburgh, on March 1. Mr. Jamieson's subject was "The Production of Oil from Coal."

In the course of his remarks, Mr. Jamieson said that his own introduction to cannel as a potential source of oil dated back to the latter days of the war, and he could recall the feverish activity and the lavish expenditure of time, money, and material in a vain attempt to equip certain selected gas-works for the carbonization of cannel with the object of augmenting our fuel oil supplies. Before embarking on that expenditure, the Government advisers must have satisfied themselves that cannel was available in sufficient quantity to be at least helpful. Since little or none had been used in the interval, the position to-day could not be less favourable. This contention was supported by a report published recently by the Scottish Development Council, which stated that the estimated reserves in Scotland containing less than 8% of ash was over 25 million tons, over 20 million tons being in the Lothian coalfields, and cannels with over 8% ash, 50 million tons. The potential maximum day's output was stated at 1,500 and 1,600 tons, respectively. Those figures indicated that Fife and the Lothians had sufficient cannel between them that, given suitable mining conditions, they could supply for 45 years an output sufficient to equal the throughput of Scottish shale. Moreover, this cannel would yield from each ton twice the volume of oil.

A Joke with Point

Two popular cabaret artists, Kenway and Young, giving a recent performance at the Grand Hotel, Torquay, paid gas an unsolicited tribute in a neat little joke. One of them, taking the part of a scoutmaster, remarked:

"With regard to the fire-lighting competition, although I said that fires were to be lighted without wood or paper and only one match was to be used, I did not think that George Groggins would stoop so low as to use a gas-poker. This is, of course, barred and he must remove his Domesticity Badge forthwith."

As the Cabaret in question was broadcast on the Western Regional Programme, this unsponsored piece of publicity must have been heard in many homes.

New Showrooms Opened at Llanelly

Imposing new showrooms and offices were opened by the Llanelly Gaslight Company on Feb. 23. The ceremony was performed by the Mayor in the presence of a representative gathering.

The new building has a frontage of 50 ft. on Murray Street and a depth of 30 ft. It consists, on the street level, of a commodious showroom fitted with non-reflecting windows giving a clear and uninterrupted view from the front, with a counter and office at the back, for the reception of consumers. The main lighting is by means of nine Sugg's 6-light "Tintern" ventilating lamps, fitted with clock control. Various coke grates and built-in gas fires are displayed in action. There is also a section devoted to the display (in operation) of various types of gas water heaters. Plug-in points are provided for the demonstration of appliances.

On the first floor is a Demonstration Hall with seating accommodation for 180 persons where it is proposed to hold frequent cookery lectures. This Hall is also provided with a Projector Room for the exhibition of sound films. The lighting is by means of "Spherelite" cluster units.

The second floor consists of well-lighted general and private offices, and Board Room. Access to the first and second floors is assisted by a passenger lift in the stair-well.

The building is heated by means of a low-pressure hot water system supplied by a thermostatically-controlled gas boiler, together with modern built-in gas fires. "Nautilus" flues are embodied in the structure of the building.

Both the permanent and demonstration lights throughout are switch controlled. The decorative scheme is tastefully carried out in shades of buff and green. The Architect was Mr. Herbert Jones, F.R.I.B.A., of Swansea.

Preceding the opening ceremony, a luncheon was held at the Thomas Arms Hotel, at which Mr. Henry F. H. JONES (Chairman of the Company) presided.

In the absence of Colonel W. M. Carr, O.B.E., T.D. (Managing Director, United Kingdom Gas Corporation, Ltd.) the toast to "The Corporation and Borough of Llanelly" was proposed by Mr. PROSSER JONES (Cardiff).

Mr. Jones said that when the United Kingdom Gas Corporation appointed him to the board of the local Company he was brought into closer contact with the town, and impressions he had gained were of its up-to-dateness, the prosperous appearance of the shops, and the look of freshness and efficiency everywhere. Where those things were found was a very virile and progressive public authority.

Responding, Councillor DAVID JENNINGS said the United Kingdom Gas Corporation had started an enterprise in Llanelly, and were not afraid of its future; neither were they afraid of the town's future. And as a hint of the possible future, he said: "At one time you lit the streets of Llanelly with gas; that might be repeated."

Mr. J. H. MONTGOMERY (Borough Surveyor) submitted "The "Llanelly Gaslight Company" He said the Company had been in existence for over a century, and was one of the oldest industries in the town. It had been founded by men prominent in the social and industrial life of the town, and confident in its future. He welcomed the new Directors and the new Manager, Mr. H. G. Horwood, and assured them of assistance in the development of the Company.

Reply was made by Mr. HENRY F. H. JONES, who spoke of a talk with the Mayor, who suggested that the day of the small business man was over. There was something in that, but his Corporation could and would bring assistance to the Llanelly Gaslight Company in financial and technical matters. Taking the long view, he thought that their control of the Company would benefit the town as well as his Corporation. But the only way he could see to cheaper gas was for them to sell more of it.

In declaring the new premises officially open, the MAYOR OF LLANELLY (Ald. Elias Davies, J.P.) said the first Gas Company in the town was constituted by Act of Parliament in 1835 with good support and solid foundation. It was no surprise to him that the Company had reached its present position. The Mayor also referred to the changes in the governing body of the Company, which was now carried on by the United Kingdom Gas Corporation, Ltd. He appealed to the Directors to make people acquainted with the facilities that Llanelly could offer in regard to new industries.

Mr. HENRY F. H. JONES then presented the Mayor with a gold cigarette box, and, referring to the Mayor's appeal, said that wherever the Company had a business interest, they lost no time in bringing that town's advantages to the notice of business men concerned in new industries, and offering them cheap gas for industrial consumption.

To mark the opening of the showrooms, there were special exhibitions and demonstrations of modern gas appliances throughout the week in the Demonstration Hall. The demonstrations were given at 3 and 7 p.m. each day by Miss Sybil Curd, of R. & A. Main, Ltd.

Gas Cookery Demonstrations at York

In connexion with "Gas Cooker Fortnight," a Series of Cookery Demonstrations was opened at York on Monday, Feb. 21, by Mr. H. E. Bloor (Director and Secretary of the York Gas Company) in the Demonstration Hall at the Davygate Showrooms.

The Lectures were given daily by Miss Janet Brink, Cookery Adviser to the Company, and so great was the response to the advance publicity and invitations sent out that it became necessary to limit the attendances to the seating capacity of the Hall. An attractive programme of Lectures was presented, dealing with many interesting aspects of home cooking, such as "The Clever Cook Has a Dinner Party," "Economy in the Oven," "Snacks for Supper," "Dishes from Other Countries," "How to Deal with Left-Overs," &c.

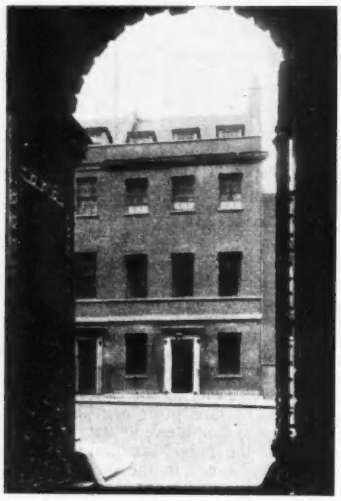
In the first week the attendances numbered over 1,050 at five Demonstrations, and the popularity of the Demonstrations and the keen interest displayed in gas cooking should do much to advance the cause of gas in York.

Mr. H. E. Bloor on the Demonstration Platform with Miss J. Brink

Gas Central Heating and Hot Water Supply

For No. 10 Downing Street

An interesting system of Potterton gas-fired boilers for central heating and domestic hot water supply has recently been installed at the Prime Minister's Official Residence.



The modest exterior of the house in which world history has been made.

There can be few houses in the country—indeed, in the Empire—which make a greater claim upon the interest and imagination of the public than No. 10, Downing Street. Behind an unpretentious Georgian exterior in that modest little street off Whitehall stands the building within the walls of which world history has been made. Alike the Mecca, perhaps, of all aspiring politicians and the place where leaders of world affairs and deputations from the humblest citizens have had audience of the heads of successive British governments, this house has been the scene of momentous decisions which have played no small part in moulding the destinies of nations.

The front of the Prime Minister's official residence belies what exists beyond. People who gaze meditatively up at it under the impression that they are looking upon the windows behind which the great man himself is working or the Cabinet is sitting are, we fear, sadly mistaken. But in shattering these illusions we would at the same time offer, by way of compensation, the thought that by walking round to the back and viewing the house from the Horse Guards Parade one not only gains a better impression of the house, but also looks more nearly on the "heart that beats within." For here, and at the side overlooking the quiet little garden flanked by its high brick walls, one can glimpse the rooms which stir the imagination. Here are the windows of the Cabinet Room, the Prime Minister's study, the "state" dining-room, and the private apartments. From here the true dimensions of the house can be visualized, which is impossible from Downing Street itself.

We were privileged recently to visit No. 10 in connexion with the considerable scheme of interior modernization and re-decoration now in process of completion—a not unimportant feature of which is the installation of a gas-fired central heating and hot water supply system.

The gas boiler installation which is housed in the original coke boiler chamber in the basement consists of two Potterton No. 3 Series "REX" units of five sections each for central heating with space available for a third unit which it is proposed to add when the extensions to the heating systems are completed. This will give a final capacity of 1,875,000 B.Th.U. per hour.

Each boiler will have a 4 in. flow and return fitted with valves to isolate any unit assembled into 4 in. flow and return headers behind the boilers, and from the flow header various circuits are carried to the radiators.

The return from these circuits are brought back to a similar header on the side wall with a main 4 in. connexion to the return header behind the boilers, the whole being arranged for accelerated circulation.

Two "D" Series "REX" boilers of six sections are provided for domestic hot water supply, each having a capacity of 198,000 B.Th.U. per hour serving two 150 gallon hot water storage cylinders encased in steel insulating jackets crossed coupled to allow of either or both being drawn upon according to demand, or isolate one boiler for maintenance purposes without interruption to the continuity of the supply.

The boilers are fitted with the latest types of thermostatic control, automatic cut-offs, and simple lighting devices, as well as pressure governors. The central heating units are additionally controlled by a variostat operated with one bulb on the roof and one in the flow main thereby governing the temperature output of the boilers in relation to the *outside* air temperature. A clock-controlled time switch is also incorporated to provide for shutting down the plant at 10 p.m. and re-starting it at 6 a.m.

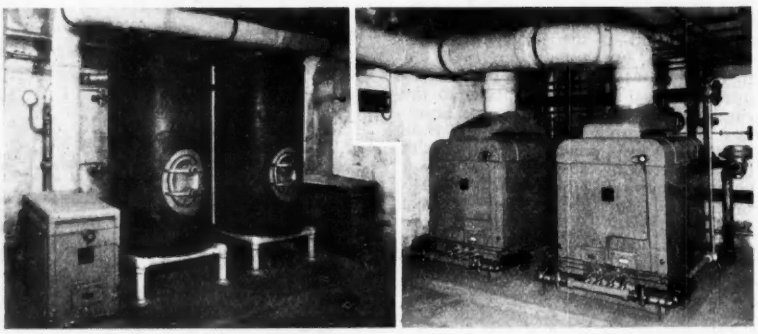
The circulation is assisted by an electrically-driven "Monopump." There are actually two of these pumps side by side, though only one is necessary to promote the circulation of the water; the other acts as a standby, and in the event of one breaking down the other can immediately be brought into operation. The faulty pump can then be quickly removed from the line by the substitution of a length of ordinary tubing which is kept, together with the appropriate spanners, on a bracket on the wall above.

Flue System.

The flue system is of interest and provided a considerable problem for the engineers, it being impracticable to make use of the existing flue which served the displaced coke boilers. This is how the problem was solved. Immediately above the boiler chamber is the main entrance hall, in which there was a solid-fuel grate. It was decided that this grate could be dispensed with, and the opening was therefore closed up and the flue extended downwards to make an aperture of similar dimensions at ceiling level in the boiler chamber. The "Urastone" ducting from the various boilers was led into this aperture and the products thus allowed to "exhaust" into the existing chimney while at the same time assisting the ventilation of the boiler chamber itself, and the system works excellently, with no signs of condensation.

The original coke boiler flue has been bricked up save for a small air-brick just below the ceiling, which aids the general ventilation.

Gas is supplied to No. 10, Downing Street by means of a 6-in. service pipe, which passes direct to a 6,000 cu.ft. per hour meter, fitted with a 4-in. by-pass. The supply is thence taken direct to the boilers through a 4-in. pipe. From this pipe a lead is taken to two 700 cu.ft. per hour meters which register subsidiary supplies for cooking and other purposes. Arrangements have also been made in the boiler chamber for the separate metering of supplies to



(*Left*) The Domestic Hot Water Boilers and (*right*) two of the three Central Heating. The Variostat Mechanism and Clock Control can be seen on the wall (*centre*).

both central heating and hot water boilers if desired at any time for checking purposes.

Our tour of the principal rooms of No. 10 demonstrated the neat arrangement of the heating system and at the same time indicated the efficiency of the installation—for, in spite of a particularly cold day, pleasant temperature conditions were noticeable in all the apartments.

Concealed Pipes.

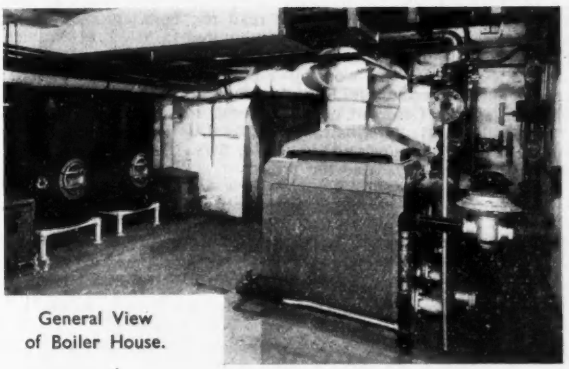
All flow and return pipes are concealed, and advantage has been taken of the thick walls to position the "Pall Mall" radiators in the recesses below the windows, where they are fitted behind a wooden casing which harmonizes with the decoration scheme. The tops of these "cabinets" or enclosures form internal window-sills into which are let metal grills through which the warm air ascends into the room. A narrow space at floor level allows for the intake of cooler air, which passes over the heated surfaces and out through the grills above.

The Cabinet Room—a dignified yet pleasingly comfortable apartment with its long table, capable of seating 22 persons, and its book-lined walls—is fitted with a special room thermostat in an inconspicuous position, while on the Cabinet table is a self-contained temperature recorder, on which we noted a remarkably "straight-line" reading, notwithstanding the intermittent use of a solid-fuel fireplace in the Cabinet Room. Whether the latter will be needed as much as before is a matter for conjecture. Theoretically, of course, it should be quite unnecessary; but doubtless Cabinet Ministers share the average Englishman's love for the open hearth and something to poke in moments of stress! In any case, the room thermostat takes care of this, and so prevents any possibility of over-heating.

Similar treatment of the radiators is provided in the "state" dining-room—a beautiful oak-panelled apartment where kings and queens have often been entertained by Prime Ministers. Here again, the heating surfaces are concealed behind panels which harmonize with the walls of the room. In the private rooms, such as the "family" dining-room, the drawing-room, the studies of the Prime Minister and his wife, as well as in the bedrooms, the radiators have been set behind low window seats, the same principle of metal grills being employed. The bedrooms at No. 10 are unexpectedly fascinating and homely, with their dormer windows, and ceilings on one side sloping almost to the floor. Gas points are provided beside the fireplaces in the bedrooms for auxiliary heating if desired. There are also radiators and heated towel rails in the several bathrooms, the bedrooms having additionally their own hot and cold water supply.

The re-decoration scheme includes a number of modern tiled fireplaces by Bratt Colbran, Ltd., and the Heaped Fire Company.

The opportunity was taken of looking into the kitchen, where we noticed that all the cooking is by gas. There is a twin-oven Davis range, two Richmonds cookers, together with a large gas hotplate and pastry oven. Altogether, therefore, it may be said that there is a very good load for gas at the Prime Minister's house.



General View of Boiler House.

In conclusion, we may, perhaps, be allowed to express the hope that Mr. Neville Chamberlain and his successors at No. 10, Downing Street for many years to come will find cause for satisfaction in the automatic gas heating system which provides true comfort conditions in the house around which the government of the country revolves.

Swindon's War Office Contract

Climax to Five Years' Phenomenal Development

We were able to refer briefly last week to the huge War Office contract obtained by the Swindon United Gas Company. By the courtesy of the *Evening Advertiser*, we can now give further particulars of the services which gas will be called upon to render.

Enterprise, combined with the influence of modern enlightenment and national defence, says our contemporary, has served to give the Company a prominent association with the building up of the new township that will soon make its appearance at Shrivenham, near Swindon. The 2nd Group of Anti-Aircraft Artillery is to be stationed there, in the picturesque grounds of Beckett House, and eventually it is estimated that a new community of between 8,000 and 9,000 people will be brought into the area. The vast benefits that this development will confer upon Swindon have already been demonstrated, and in a most striking way, by the news that the Swindon United Gas Company has received the contract for supplying this embryo little "town" with its gas requirements for central heating, cooking, water heating, and so on.

> The contract is the largest of its kind ever issued in this country by the War Office, and will be the means, when completed, of increasing the Company's load by 150 million cu.ft. This is equal to an increase of more than 35%, for the amount of gas distributed last year was 430 millions.

In order to meet this heavy demand important extensions will have to be made at the Swindon Works, and plans are in hand for increasing the output of gas. There will be extensions to the retort houses, boosting and other machinery, and a new gasholder will also be provided.

Cirencester Link-Up.

Several miles of mains will have to be run out, and, at the same time, the Company will take the opportunity of linking-up with Cirencester. The works at Cirencester will, as soon as this is accomplished, be closed down.

When developments in connexion with Shrivenham, and the taking over of Cirencester's gas supply, have been completed, it is estimated that Swindon's output of gas will be something like 850 million cu.ft. per annum.

The progressive expansion of the Company's interests during the last five years—that is the period, up to the present, of Mr. Cecil H. Chester's association with the Company as a Director, General Manager, and Secretary—has been phenomenal. Within this comparatively short space of time the sales of gas, in therms, have soared from 1,170,000 to 4,037,500. That is an increase equal almost to 400%.

Equipment to Meet Extra Demands.

A sum of about £75,000 will be spent during the next three years in equipping the Swindon Works to meet the extra demands that are to be made upon them, and contracts and specifications have already been issued. The work will be put in hand some time in April.

The placing of the War Office contract has served once again to emphasize that gas is a most economic and reliable medium for cooking and heating services, whether on the modest scale of home life or the immense style of the modern military barracks.

When completed, the Shrivenham camp will be a perfect illustration of that new idea in barrack design that aims at making soldiers feel as much at home as is humanly possible.

Heating Plans.

The system of central heating to be installed will be precision-controlled, enabling any part of the different buildings to be heated independently, if necessary.

In addition, hot water will constantly be on tap. For this purpose a series of automatic gas boilers—probably 14 in number—will be provided, and the output from each will be more than 3,000,000 B.Th.U.

Incidentally it is hoped, through the medium of this station, to set a supreme example of what might easily be accomplished elsewhere in preserving the countryside from the begriming and injurious effect of the smoke nuisance.

> The establishment of the new military "township" at Shrivenham will not, thanks to the introduction of gas, in any way interfere with the purity and freshness of the air or the beauty of the country in which it is set. There will be no smoke.

National Cooker Fortnight Activities

Prizes for Schoolboys' Essays on Gas

In connexion with National Cooker Fortnight, three prizes were awarded by the Newton-in-Makerfield Gas Department for the three best essays written by schoolboys of 10 to 13 years.

Some time ago all schoolboys in the Earlestown and Newton districts received booklets, "Mister Therm rhymes for modern times"—which, of course, dealt with gas and the by-products of the Industry. Local headmasters co-operated with the Gas Department, and after the boys had read the booklets they wrote essays on the subject. These were submitted to Mr. J. H. Warren (Clerk of the Council) and Mr. F. C. Sylvester (Gas Engineer) and the first prize was won by Victor Dickinson (Manor C.E. School) and the second and third by Frank Frodsham and Edmund Hill (Earlestown Central Council School), respectively.

Councillor A. Tully, Chairman of the Gas Committee, accompanied by Mr. Sylvester and Councillor Mrs. E. Crouchley, visited both schools and presented the prizes.

Health Week Exhibition at Colwyn Bay

Sir Bruce Bruce-Porter, K.B.E., C.M.G., M.D. (on the *left*), Ald. Robert Howard, J.P., L.D.S., the Mayor of Colwyn Bay, and the Mayoress, Mrs. David Edwards, on the gas display stand, at the Health Week Exhibition, held recently in the Pier Pavilion, Colwyn Bay.

Minister of Health Opens Food and Cookery Demonstrations

We referred recently in these columns to the series of Food and Health Demonstrations organized in successive weeks throughout their area of circulation by the *Kentish Mercury*, in which the South Metropolitan Gas Company are co-operating.

The third week in the series was held at Eltham and was given a good send-off by the presence of Sir Kingsley Wood, Minister of Health, on Feb. 28, when over a hundred were present in the Parish Hall to witness the demonstrations and film displays.

A number of interesting displays were arranged around the hall, including the South Metropolitan Gas Company, the Potato Marketing Board, the National Milk Publicity Council, and others. Examples of all the latest types of gas appliances were shown by the Gas Company, together with attractive posters illustrating the story of "balanced meals" and the banishment of smoke by the use of gas, coke, and "Metro-Coalite." The smoke abatement "corner" was particularly forceful in its appeal, the effect of the continuous deposition of soot on the face of buildings being strikingly demonstrated by a stone, including a carved rosette, provided by H.M. Office of Works from a London building. The remarkable amount of soot and grime adhering to this stone gave an idea of the damage done by smoke and provided a "close-up" rarely observed by the public in the ordinary course of events.

In introducing the Minister of Health, Mr. D. M. Jackson (representing the *Kentish Mercury*) remarked that Sir Kingsley Wood was known both for his work in connexion with the public life of Eltham and in the wider sphere of National affairs. They were very proud and pleased that he had come there on that occasion to open that campaign in the cause of National fitness.

Sir Kingsley Wood expressed his pleasure at being in that hall once again. That week marked a quarter of a century's association with that constituency, for it was 25 years ago that he had been first elected a member of the London County Council for the division, while he was also glad to be representing the constituency at the present time in the House of Commons. He was also pleased to be associated with these demonstrations which had been organized by one of the newspapers serving that area. They were very fortunate in their Press in that part of London, and he himself had been a constant reader of the *Kentish Mercury* for almost 25 years. As Minister of Health he was grateful to the newspaper for organizing these demonstrations. Wonderful strides had been made during the last hundred years so far as public health was concerned, and he gave a number of interesting facts and figures in support of this. This National Fitness Campaign, he emphasized, did not mean compulsion. They did not advocate in this country that people should be compelled to go through all sorts of physical exercises. They believed in the voluntary system so far as this campaign and others were concerned. It was not everybody who was able to indulge in physical jerks, and alternative methods included better housing, better nutrition, better health services, and so forth. He had great pleasure in declaring these demonstrations open, and he wished them every possible success.

An Interesting Programme

A very interesting programme was arranged, this being repeated at the two daily sessions throughout the week. First was a display by members of the Women's League of Health and Beauty. This was followed by the Nutrition film, after which was a cookery lecture by the South Metropolitan Gas Company's Demonstrator, the subjects varying each day and the recipes being subsequently published in the *Kentish Mercury*. Two further gas films completed the demonstration, one illustrating the menace to health of smoke and the advantages of smokeless fuel, and the other being "The Man Who Knew Too Little," both of which have been reviewed in these columns.

Although it may be said that gas plays a prominent part in these demonstrations, there is no blatant propaganda about the show. Indeed, gas is hardly mentioned anywhere, the whole value lying in inference and the natural association of the various demonstrations and films with the adjoining displays of gas appliances. The demonstrations are continuing for a further seven weeks in different centres.

Admission to each demonstration session is free of charge, and at the afternoon session tea and biscuits are served to each member of the audience.

A Gas Fire Display at Liverpool

This attractive display of High "Beam" gas fires was arranged recently in the window of the new Liverpool Gas Showrooms The colour scheme was carried out in two shades of marble in keeping with the interior decorations of the showroom, and arrangements were made for floodlighting each of the fires. The window space occupied was 10 ft. wide, and the pleasing and dignified appearance of the whole ensemble attracted considerable attention. The fires illustrated are Richmonds' (Radiation Ltd.) "Cloister," "Rugby," "Westminster," "Flambeau," and "Reflector" in their well-known lustre finishes.

Proud Record of Service to the Gas Industry by Old-Established Yorkshire Firm

The New Welding Shop—a recent Extension of the Works.

Comparatively recently we visited the Works of Messrs. W. C. Holmes & Co., Ltd., at Huddersfield, and were impressed not only by the extent of the Works but also by the modern equipment installed. On Saturday last we toured these Works anew on the occasion of a joint visit by the Yorkshire and the Manchester District Junior Gas Associations, and were again impressed, but not surprised, by the progress made by this enterprising firm, which manufactures most of the plant which it sells. The number of those attending this meeting was indicative of the interest shown in the firm's products, and it was difficult for the guides to drag the parties of which they were in charge from the exhibits which were to be seen. It was at the Institution Meeting in June that the Harrison purging machine was described. On Saturday last two types of this useful machine were shown, one of them being of the portable type of a capacity of 10,000 cu.ft. per hour. We understand that these machines are now available on hire terms—a service which will be readily appreciated by the Gas Industry, and particularly by the smaller undertakings. This is typical of the way in which the firm meets the needs of the day. Then we were shown the construction of the Brandl-Marischka meter, which requires such a nicety of welding workmanship. As a matter of fact, Messrs. Holmes were one of the first engineering firms to install welding equipment in this country. It may be remarked that one of the B.M. meters shown, which attracted a great deal of attention, has a capacity of 60,000 cu.ft. per hour. It is not our intention to enter into detail concerning the many improvements in plant construction which were on demonstration, but we must mention the developments which have been made by this Huddersfield firm in the system of jointing for benzole rectifying plant, and lest it should be thought that only the larger undertakings can profitably recover benzole there was a salutary exhibit of a plant designed for a very small works. The firm realizes the importance of keeping in touch with international developments, and as an example there was on view a Kemp immersion heater, the popularity of which has been based on a solid foundation in the United States of America; it is a system which, we feel sure, will meet with a good reception in this country.

The equipment for high-speed cutting of iron castings was remarkable, as also was a planing machine which travels along the work, as distinct from the normal machine which necessitates movement of the castings. And then we had a demonstration of a new design of bubble-tray tower scrubber.

We have already mentioned the interest which Messrs. Holmes have taken in welding work; and one of the recent extensions to the premises is a new department for the electrical welding of steelwork. This new building is shown in the photograph at the heading of this article, and we may mention that it covers a floor space of no less than 1,420 sq. yd. The application of welding to gas-works plant has, of course, of recent years made great progress, and the firm has not been slow to take advantage of this technique.

The Erecting Bay.

We have not detailed the many items which were to be seen and admired by the Junior Gas Associations on their visit last Saturday. No reference, for instance, has been made to the large foundry, where the latest tamping machines were seen in operation, or to the fully-equipped pressing shop. In this section the manufacture of mild steel bends was demonstrated, the pressed sections being jointed-up by electric welding.

"Progress." This must have been the dominant impression of all who were happy to participate in this most interesting and well-arranged inspection. To-day the firm of Holmes may with legitimate pride recall the year 1880, when they first occupied the site of their Works at Huddersfield, then one-sixth of the present size.

Part of the Foundry.

One Bay at the Machine Shop.

The Joint Gas Conference at the Fair

MARCH 1 to 3

OFFICIAL WELCOME TO THE DELEGATES

The EARL OF DUDLEY, M.C.,
President of the British Gas Federation.

The Earl of Dudley presided at the Joint Gas Conference which opened at the British Industries Fair at Castle Bromwich on Tuesday, March 1, under the auspices of the British Gas Federation.

There was a large attendance of delegates when a welcome was given to the Conference by the Lord Mayor of Birmingham (Councillor E. C. Canning). Those present included Sir Russell Bencraft, Councillor W. P. Jackson (Manchester), Councillor A. S. Giles (Chairman, Birmingham Gas Committee), Mr. H. C. Smith (President of The Institution of Gas Engineers), Mr. A. W. Smith (Birmingham), Mr. R. J. Rogers (Chairman of the Society of British Gas Industries), and others.

Lord DUDLEY read a letter from Sir David Milne-Watson regretting that he was unable to be present, and adding that he was pleased to know the Gas Industry was strongly represented at the Fair, and hoped that the Conference would be very successful.

The LORD MAYOR OF BIRMINGHAM welcomed the delegates, and hoped that the Conference would be successful in every way. The Gas Industry had given great support to the Fair, and he well remembered the first Conference held in a marquee specially erected for the purpose. The Industry had put up a wonderful fight against competition. He believed that competition was a good thing because no doubt it had brought out the best in the Gas Industry. The amount of research that had been put into the Industry in the last few years had not only been of benefit to the Industry but it had given them a much more reliable product than they had years ago. He noticed that in the Fair there was very considerable improvement in the technical details of heat treatment. There was no doubt that in Birmingham, which was so closely connected with the metal trades, the advance made in the heat treatment of metals had been very marked.

They were very proud of the gas undertaking in Birmingham. It was the first outstanding achievement of the late Joseph Chamberlain, and it had gone on from strength to strength until to-day it was the largest municipally-owned gas undertaking in the world. The capital of the Birmingham undertaking was £5,600,000, and he was glad to say that £2,400,000 had been redeemed. He noticed that they were going to deal with smoke abatement and he could safely say that in Birmingham there had been a considerable improvement in his time covering about 30 to 40 years. The extended use of smokeless fuels provided by the gas undertaking had done much to keep the city free from grime and soot which were often thought to be a necessary evil in an industrial community. What had happened in Birmingham had happened in the whole country, and he looked forward to the ideal of a smokeless city where it would be possible for a man to live near his work and enjoy the fresh air and sunshine which he could now only obtain by making his home at a distance from the factory. He had seen a remarkable development in that Fair in the Gas Section in relation to water heaters and other appliances, and there seemed to have been some vigorous competition among manufacturers in the last year or two. The feeling of optimism in the Gas Industry generally might be somewhat tempered by the coal position, but he would leave that for technical men to deal with. He would like to thank them for the interest which they took in the Fair year by year, and he hoped they would find it profitable and useful to their interests for many years to come.

Lord DUDLEY expressed the thanks of the Conference to the Lord Mayor for his welcome. The interest which had been shown by successive Lord Mayors in the Gas Conferences held at the Fair was a recognition of the service which the Gas Industry rendered to the community. He was told that the peak load in Birmingham was on a Sunday morning, and that showed the enormous number of gas cookers of various sorts that must be sold to the citizens. They recognized the city as a most valuable customer of the Industry, and the Industry was glad to be recognized by the presence of the Lord Mayor for the service which it gave to the city.

He had also to welcome the Conference in his capacity as President of the Birmingham Chamber of Commerce, and he had much pleasure in doing so. "I regard my Presidency of the British Gas Federation," Lord Dudley said, "with a great sense of honour. I feel that it is a job really worth doing, and I am only too glad to do what I can to help on your aims and your ideals."

PRESIDENTIAL ADDRESS

By The Rt. Hon. the Earl of Dudley, M.C.

Reading a newspaper the other morning I saw the heading "Use of Gas to be Prohibited?" I could scarcely believe my eyes until, reading on, I found to my relief that the article dealt with the possible prohibition of poisonous gases in time of war. Nevertheless, that heading remained in my mind and in view of my forthcoming Presidential Address to you it seemed to me that perhaps I could not find a better text. So I propose quite briefly to examine the state of affairs that would arise if actually the Gas Industry ceased to function, and its invention had to start again from zero.

To-day, 50% more gas is used than 20 years ago. The latest available statistics show a 4·3% increase in gas consumption for the last twelve months. The number of consumers has reached a record figure and the consumption per consumer has grown.

In the unlikely event of the Gas Industry ceasing operations we should be afforded an opportunity of trying to estimate very roughly what would be the position in such a case, and in so doing we shall obtain an idea of what that Industry means to the life of the country.

Take first of all the domestic use of gas. We have a total of some 11,600,000 consumers and 8,000,000 women, so I am told, cook regularly by gas. That facility would disappear. Substitution of the only practicable alternative method would call for expenditure that could not be faced even if time were available to make that provision. For that statement I have no less an authority than Sir David Milne-Watson who said recently that the Sunday cooking load of London gas companies was 2½ times the total installed capacity of electricity generating stations serving the Metropolitan area. To cope with this load £300,000,000 would have to be expended in the

provision of new plant. To meet that call for the whole country would necessitate expending at least five times as much; in other words, a sum equal to the entire cost of the country's Rearmament programme.

The absence of gas heating would cause the most serious discomfort. It would certainly disarrange medical services, for actually three out of every four doctors and three out of every four hospitals and nursing homes use gas for heating.

In one Company's area alone the 274,000 gas appliances installed in 1937 would cease operation, to say nothing of the many hundreds of thousands installed previously. In this same area 40,000 gas refrigerators would be useless. The country would have to abandon what, after all, are its comparatively modern habits of cleanliness and the Friday bath night would again become a national rite. There would be no possibility of getting a pot of fresh tea from boiling water which, I see from some of the exhibits in the Gas Section, can now be obtained by new gas appliances in 30 seconds.

What about domestic lighting? Here I think sometimes that even gas engineers fail to realize the size and importance of this load. So far as can be ascertained between 40 and 45% of the domestic lighting in this country is gas lighting. What chaos would occur if gas-works failed to function.

There are some 800,000 gas street lamps in this country, constituting roughly two-thirds of the Nation's public lighting. A 40% increase in consumption since 1925.

In 143 towns in which both gas and electricity undertakings are owned by the Municipality nearly 80% of the public lamps are lit by gas. A notable feature of public lighting during the past year or two has been the large number of long-term contracts signed with gas undertakings. Westminster recently signed a 15-year contract, and there have been many others for a similar length of time, and still more for a period of 10 years. If gas lamps were abolished there would be an appalling increase in road accidents.

The recent Report of the Ministry of Transport Departmental Committee has made the safe lighting of traffic routes and residential roads a matter of some urgency, and in the near future there is bound to be great activity in carrying out these recommendations. The Gas Industry, with its age long experience of public lighting, has already drawn up plans to meet fully the Committee's suggestions. A publication, "Light on the Roads," was issued by the British Commercial Gas Association within a few days of the Report being published, and it will be a great mistake if all bodies and individuals concerned in the lighting of our roads do not take advantage of this valuable work when they are considering their extensions and improvements.

But the increase in domestic and street lighting consumption is accompanied by rapid progress in the industrial field. Some 15% of the total gas consumed in the country now goes to industrial purposes.

What is the reason for this increased use of gas in industry? Mr. A. W. Smith, General Manager and Secretary of the Birmingham Gas Department, expressed it well when he said that to-day manufacturers undoubtedly admitted the futility of regarding the cost of fuel as an isolated item, and were considering it in relation to rate of production, percentage of scrap produced, quality and uniformity of the finished product and possible reduction or elimination of subsequent processes, such as pickling, polishing, &c. Items such as the saving of floor space, certainty of an adequate fuel supply on tap, and maintenance of better working conditions for operatives were also being borne in mind to a greater extent than hitherto.

Factory heating is of particular interest at the moment since the Factories Act, 1937, comes into operation in July next. For this reason the special exhibit of factory heating equipment on the British Gas Federation's Industrial Stand in the Fair is of timely importance. It is a display that should be seen by all owners of factories and by every factory inspector, since it will facilitate compliance with the provisions of the new Act.

Each year brings new applications of gas in industrial processes, usually brought about through closer co-operation between manufacturers and the Gas Industry.

Progress is reported from all parts of the country. In Birmingham, which has such a large variety of trades, one-third of the gas consumption is used industrially. That is due largely to patient research work over many years—work that has covered the smallest burners used, say, by a jeweller or glass-worker, through the range of the smaller muffle and heat treatment furnaces, up to the large furnaces used for carburizing and other operations in large motor works and large kilns used for firing ceramic ware.

You are all familiar with the fact that the steel industry in the Sheffield district—with a 70% industrial consumption, showing a 135% increase in five years—has been revolutionized, and that in the Stoke-on-Trent area, with a 40% industrial consumption, new vigour has been given to the pottery industry. But these well-known facts are only illustrative of what has been going on in many other parts of the country in places that are not so well-known industrially.

Take Stourbridge, for example. Here in two years industrial consumption has risen from under 16% to over 27%, for the glass industry is using a great deal more gas and the enamelling industry is beginning to use gas instead of solid fuel.

In the Chester district—not an industrial area—industrial gas consumption has more than trebled in a couple of years.

At Dursley, in Gloucestershire, industrial sales have gone up from 20% to over 40% in the same period. Here there have been no new industrial consumers—the increase is due to increased consumption per consumer. A manufacturer of internal combustion engines and agricultural equipment added at one sweep a further 10,000,000 cu.ft. to his consumption, and there is a steady increase in the consumption of a big firm of manufacturers of dynamos and motors. Altogether in this district alone there are 14 different industrial consumers.

Gravesend shows an increase of industrial sales from 6% to 21%. Here by the institution of special block rates a large amount of business has been secured, including the displacement of producer gas by town gas in a large electric cable manufacturing works.

Accrington and district records an 86% increase in two years.

Stalybridge is a good example of progress in the industrial field, for the percentage of industrial gas for 1932-1933 was 15·7. At the end of 1937 it had risen to 36·6. The five years show continual progress; 15, 18, 20, 28, and now 36%. In 1932 a firm of coppersmiths there used slightly over a million cu.ft. To-day they use 14 million, and one particular process is responsible for 8 million cu.ft. of this total. As a steelmaker I am concerned with the calcining of iron oxide, and I notice that one company in Stalybridge converted a large furnace from coal firing to low-pressure gas, and it now uses 15 million cu.ft. each year. A period of three years was occupied in negotiations and in experimental work but the result has more than justified the time and labour expended. Stalybridge has also a valuable load of 8 million cu.ft. per annum for singeing and calendering. Another unusual load is for banana ripening.

Here are a few typical industrial annual consumptions in big works. An aircraft company in Hertfordshire uses as much gas as the town of Malmesbury; a motor gear company in Birmingham as much as Cromer or Newquay; cycle manufacturers in Nottingham as much as Melton Mowbray; a tube company in Bedfordshire more than Pontefract; motor manufacturers in Coventry would use all Ulverston's "make"; a roller bearing company in the Midlands would absorb Aylesbury's supply; and a big engineering works in Birmingham has a consumption equal to that of Weymouth—in other words, they use as much gas as 9,000 ordinary domestic consumers.

Industrial uses are extraordinarily varied—even in a comparatively small area. In Halifax, where industrial consumption amounts to 27% of the total, gas is used for stone quarrying, mining coal, brick making, gas retort making, boiler making, machine tool work, general engineering, sheet metal working, wire drawing, tempering and annealing, cotton spinning and weaving, blankets, silk thread spinning, artificial silk manufacture, brewing, manufacture of confectionery, worsted spinning and weaving, carpet manufacture, woollen knitting yarns, and so on.

Amongst commercial consumers we include such businesses as hotels, bakeries, laundries, Turkish baths, hospitals, fish-frying establishments, and, of course, crematoria.

What is probably a record in catering engineering has been achieved at the vast new exhibition and entertainment centre at Earl's Court. It houses seven kitchens and gas is the only fuel used for cooking. Gas provides also all the hot water

used in the kitchens. A staff of 900 persons can serve 30,000 meals a day; and the gas consumption per hour, when all the kitchens are fully employed, is 25,000 cu.ft.

Fish frying may not, at first sight, seem to offer very great possibilities, but it is estimated that there are over 30,000 fish fryers in the country, and the majority of those have in recent years substituted gas for other fuels. That industry is quite obviously not unimportant for it provides nourishing hot meals at a price within the means of practically everybody. Incidentally, it is, so I am informed, one of the biggest distributors of free literature in the country.

In these two sections—industrial and commercial—some 4,000 trades make use of gas in various processes. I have been able, naturally, to instance only a few. Abolish the use of gas in industry and where would industry be?

Then we come to by-products of the carbonization of coal by the Gas Industry. Over 12,000,000 tons of coke. Again, as a steelmaker I know that there is no substitute for that product, especially in terms of smoke abatement. 234,000,000 gallons of tar, so essential for the maintenance, for example, of our wonderful arterial roads. 86,000 tons of sulphate of ammonia each year, which the farmer needs so badly. 16,000,000 gallons of benzole; British-made scents of all kinds; dyes and chemicals.

And so one could go on. The cessation of gas production would take away the biggest customer from the coal industry and would put out of employment nearly 70,000 mine workers. Add to this number those employed by gas undertakings and the employees of manufacturers of appliances and plant, and we find that at least 300,000 people are in work solely because over 18,000,000 tons of coal are carbonized each year in British gas-works. Add to these those engaged in industries making use of these by-products and the total is considerably greater.

If we are to invent the Gas Industry we may as well make provision for the future; for the end is not yet and there are still vast fields to conquer.

Until gas has definitely reached saturation point the Industry, I am confident, will not relax its efforts. I am sure Sir Philip Dawson will not mind if I quote from his recent Presidential Address to the Institute of Fuel. In this he said that there was a potential market for gas in the domestic field even greater than the total present "make." The total present production of gas annually amounted to 1,400,000,000 therms, which gave actually more than twice the heat equivalent of the electrical energy generated in this country; but the replacement of the 30,000,000 tons of coal used in British homes would call for a further 1,800,000,000 therms, so that there was great scope still left for gas domestically.

That is an object to which the Gas Industry may well devote its efforts. Until it is achieved we shall not have finished our National work.

Vote of Thanks.

Mr. H. C. SMITH (President of The Institution of Gas Engineers) proposed a vote of thanks to Lord Dudley for his Address and also for presiding. That was the third or fourth occasion upon which he had presided at the Conference, and they would all agree with him when he said he hoped it would not be the last.

Sir RUSSELL BENCRAFT, in seconding, said Lord Dudley was an ideal President and they hoped he would occupy the position for many years to come. He had two qualities which appealed to him—first, he was a sportsman, and secondly, he had a sense of humour which he thought was most important in a person holding a public position.

Dr. E. W. SMITH spoke of research in the Gas Industry. He thought that the Industry should review the present position of research as a whole. A great deal of research had been done of a very valuable nature in the past 20 or 30 years. That work had been primarily in the hands of contractors, the gas fire makers, the water heater people, and the like, apart altogether from the major industries. He felt there ought to be a greater national co-ordination within the Industry for research. That was desirable in view of what they would have to do and of what they would have to depend upon 20 years hence. They did not want to jump to the idea that every piece of research was going to be revolutionary, but it might be the basis or the germ of something on which the Industry would be completely dependent in the future.

Smoke Prevention

By Sir PHILIP DAWSON, M.A., M.P., President of The Institute of Fuel

Sir Philip Dawson, M.A., M.P.

Since this Paper must of necessity be short and non-technical in character, I propose to confine it to a consideration of the smoke problem as it is affected by the burning of raw coal in domestic grates; and in view of the occasion it will be understood if most of my remarks are directed specially to members of the Gas Industry.

It is for this reason that I make no reference to the electrical industry, which is contributing its part to the solution of the smoke problem, or to the inestimable benefits the public and the railway shareholders would alike derive were the enlightened and progressive policy, as regards railway electrification, pursued by the Southern Railway followed by the other railway companies.

Ever since the use of coal became general in this country, there have been spasmodic agitations in favour of smoke abatement. Six hundred years ago a man was brought to trial on a charge of burning coal in London. He was found guilty and executed. At that time, and for long afterwards, public opinion was solidly against the smoke-producers. A writer in the early seventeenth century recorded that "the nice dames of London would not come into any house or room where sea coals were burned." The nice dames of London cannot afford to be so fastidious to-day. It is only too probable that they are themselves contributing to the smoke problem, in common with 90% of other British householders. If our ancestors were right in regarding the production of coal smoke as a crime, then we are a nation of criminals, for it is generally accepted that the open fire in the ordinary household grate is responsible for the bulk of atmospheric pollution in our towns.

A well-informed public opinion is a condition precedent to any real advances in the fight against smoke. The National Smoke Abatement Society has done a great deal of valuable educative work.

It has collected from well-known authorities a mass of evidence as to the causes and effects of the smoke nuisance, and has set out to stir the public conscience by means of

articles, lectures, exhibitions, and other forms of propaganda. It is largely owing to the Society's efforts that our newspapers to-day are beginning to treat the subject as an issue of vital importance to every citizen.

To the economist, smoke means inefficiency and waste. A commonly accepted estimate puts the cost of fog and smoke pollution at forty million pounds a year. The cost to Londoners is more than £1 a year per head, or more than the cost of the entire voluntary hospital system.

To the doctor, smoke means illness and death. The present Prime Minister, when he was at the Ministry of Health, made this statement: "Easily the first in their fatal effects are those diseases which are classed as respiratory . . . we must attribute the very high mortality which we suffer from these diseases to the congested conditions and polluted atmosphere which are to be found in our largest towns." A well-known medical officer has put the position even more forcibly: "The majority of lives lost from respiratory diseases are lives thrown away. Their prevalence and the high mortality due to them are a grave indictment of our modern civilization. They are preventible: yet they are not prevented. They are curable: yet they continue to kill. Prevention can only be achieved by tackling the smoke nuisance resolutely." More people are killed by soot than by motor cars.

To the ordinary housewife in our big towns, who already has her full share of work and worry, smoke means more work and more expense. To take one example, it is calculated that the average housewife in Manchester takes an hour longer over her weekly wash than the housewife in Harrogate, and spends 7½d. a week extra on washing materials and fuel.

To all of us who live in towns, smoke means a measurable loss of sunlight, dirtier streets and buildings, fouler air. In the past winter, even the most unthinking Londoner must have been shocked by the frequency and intensity of the smoke fogs which fell on the world's largest and richest city; and their effect was by no means confined to London itself. Here is a newspaper account of one of them:

"On Sunday, November 21, 1937, a cubic section of Kensington's atmosphere (measuring 100 yards each way) contained at one time during the afternoon 8 lb. of assorted grime. During the night a light south-easterly breeze sprang up and carried this suspended accumulation of impurity out over Middlesex, Hertfordshire, and Bucks to beyond the Chiltern Hills, where much of it came to rest on Monday.

"In South Bedfordshire villages remote from any town there was an oily black deposit on windows and water-butts, and when housewives brought in their washing from the line many of them were dismayed to find it in a worse state than when they had begun to wash it.

"This happened 40 miles from London. It appears that about a tenth of the entire area of England is liable to be made dirty by metropolitan smoke fogs. It seems probable that half of rural England may be within the pollution zones of the great industrial centres."

The worst feature of all is that the position in London has ceased to improve. Recent observations show that at four points in London (Archbishop's Park, Finsbury Park, Horseferry Road, and King Charles Street, Westminster) atmospheric pollution is worse than at the worst stations in Sheffield, Salford, and Glasgow. At six of the thirteen London stations where observations are regularly taken, an actual increase has been shown in the solids deposited compared with the average for the last five years. Conditions admittedly are far better than they were 30 years ago, owing largely to the greatly increased use of smokeless fuels; but at the best we are now only marking time.

In spite of the technical and commercial progress made by the fuel industries, in spite of propaganda conducted over many years, the hard core of the smoke problem remains. The domestic coal fire has lost little of its popularity. It ranks with roast beef as a national institution. It is often assumed that the Englishman's devotion to the coal fire is a matter of innate conservatism, a triumph of custom and sentiment over social conscience. Different methods of breaking down the psychological barrier to change have been suggested from time to time. The Samuel Commission looked forward to a future day when it would be possible for the Government to prohibit the use of raw coal or to penalize its users by the imposition of a special tax. Other authorities have suggested that a substantial rebate in local rates should be allowed to all householders who can prove that they use nothing but smokeless fuels. Such schemes are grounded on the assumption that a point must be reached where nothing but prejudice stands in the way of the universal adoption of smokeless methods of domestic heating. What is the actual position to-day?

In my recent Presidential Address to the Institute of Fuel I examined the progress made within the last ten years. I pointed out that the output of gas has risen by 10%; that the consumption of the domestic and small industrial coke markets amounts to-day to 11 million tons of gas and oven coke per annum; that a number of low-temperature carbonization plants are now in profitable operation, while others are in course of erection; and that in the coal industry itself experiments are being conducted with a view to burning raw coal smokelessly in the open fire. The advances made in the use of electricity for household purposes are well known to all of us.

Now at first sight it might seem that the increasing use of smokeless methods of heating in recent years should as a natural result have brought a very perceptible decrease in the smoke nuisance. The fact remains that at least 30 million tons of raw coal are still burned in domestic grates, a reduction of perhaps 20% on the amount so used in pre-war days. The inference is that to a great extent the increased use of smokeless fuels represents *additional* expenditure on domestic heating, rather than the large-scale displacement of coal fires.

An obvious example will serve to illustrate this point. Before the war comparatively few families enjoyed the luxury of warm bedrooms. Nowadays it is common in all types of house to find gas or electric fires in bedrooms. The use of these fires does not, in the majority of cases, mean that the family is burning less coal. The old offender, the coal range, continues its smoky operations undisturbed. The best that can be said is that the family has increased its comfort without increasing or decreasing its smoke production.

The coal range has plausible defenders. They point out that it performs two or three functions: it warms the kitchen or living room, it can be used for cooking, and it is often used for water-heating into the bargain. It may impose unnecessary work on the housewife; it may confine family life to a single room; it may yield insufficient supplies of hot water; it may contribute its quota to the smoke nuisance: yet with all these drawbacks, its retention is defended on grounds of cost. And the strongest support for the argument may be found in the fact that in many of the newest housing schemes, where gas or electric cookers and water-heaters and wash-coppers are installed, the coal range is still retained for warming the living room and providing an auxiliary means of cooking. How far is this policy justified?

The national housing campaign gave us an unprecedented opportunity of striking at the roots of the smoke problem. Lord Newton's Committee, when it reported in 1921, made the following recommendation:

"That the Central Housing Authority should decline to sanction any housing scheme submitted by a local authority or public utility society unless specific provision is made in the plans for the adoption of smokeless methods of supplying the required heat. . . . The only exception to this rule should be when the Central Authority are fully satisfied that the adoption of such methods is impracticable."

An examination of some of the latest and most ambitious housing schemes carried out in this country shows, however, that the coal range for living room heating may still be regarded as the standard arrangement. The Building Centre recently published the results of a survey of new housing schemes in the large cities of Europe. Seven schemes were selected for detailed description as being representative of the housing policy of London. In all seven of these schemes the living room is warmed by a coal fire which is also intended to be used for cooking. Thus in our newest housing estates Victorian heating arrangements are perpetuated.

There are, however, some notable exceptions. In Leeds, for example, the Corporation gives its tenants every encouragement to use smokeless solid fuel in the range in place of coal. Sassoon House, in South London, is a completely smokeless block of working-class flats, coke being used for

living room fires. The latest and perhaps one of the best examples is Kensal House, which was built by the Gas Light and Coke Company to demonstrate that smokeless work-saving dwellings can be run at a lower cost for fuel than the average working-class family has to pay for an old-fashioned and smoke-producing fuel system. In this case also coke fires, ignited by gas, are used for warming the living rooms, while gas is used for cooking, hot water, and washing. The experiment has been completely successful. The weekly fuel bill of the average London working-class family is about 6s. The weekly fuel bill of the average Kensal House family is 4s. 4d. For the advocates of smoke abatement, the importance of these facts is obvious. They cut away the ground from the traditional argument that the coal range must be retained on the score of cheapness.

It is encouraging to find the Gas Industry taking the initiative against the smoke problem in this way. Its policy, indeed, is one of enlightened self-interest, for the Industry is the largest supplier of smokeless fuel in the country. The whole course of the movement for smoke abatement shows that whatever legislative or administrative measures may be proposed, the rapid solution of the problem depends ultimately on the enterprise and energy of the whole group of fuel industries acting in close co-operation with each other. I myself advocate the co-ordination of these industries by a powerful central organization which will regard coal as the raw material of manufacturing processes and will be able to lay down a long-term national fuel policy. When we reach that stage, the end of the smoke problem will be in sight. We shall cease to talk about Smoke Abatement, because our object will be Smoke Abolition.

I have been connected with the electrical industry for many years, but I have always held up the Gas Industry as a model industry for its propaganda and research work and what it does to teach the householder to use fuel in the best and most efficient manner. To-day it is still leading the world and showing the country how to use coal in a rational manner without doing the vast damage which smoke is doing every day all over the country.

Discussion.

Mr. C. S. SHAPLEY (Leeds) said: I notice that Sir Philip Dawson at the commencement of his very interesting Paper says: "It will be understood that most of my remarks are directed specially to members of the Gas Industry." I can only hope that the message he is giving will be directed to every inhabitant of the British Isles!

It is interesting and gratifying to note that the President of the Institute of Fuel holds such excellent views on smoke abatement, which—to my mind—is one of the most important things in life to-day. The smoke caused by locomotives at the London termini and other large stations does really need attention, and although we are the Gas Industry, no one would deny that Victoria Station, since many of the steam trains have been superseded by electrical traction, is a different place to walk about in.

There are two chimneys in the centre of Leeds which are belching forth smoke every day, and the whole nuisance should be stopped. I have called attention to these chimneys on many occasions, but nothing seems to be done, and I do not know what remedy we have against these offenders. Sir Philip says that the household grates are responsible for the bulk of atmospheric pollution in our towns; this is perfectly correct. We have a very high retort house at Leeds, and I frequently go up on to the top of it on Sunday mornings and take various friends with me to point out that it is the household chimneys that are definitely causing the smoke pall. Yet we as an Industry do not seem to give the smoke abatement movement much support. I think we have been sadly lacking in this respect.

Sir Philip also says that, to the doctor, smoke means illness and death; I say it means income! I do not want to be misunderstood, because doctors—taking them generally—are advocates of gas, and I do not mean this as a joke! He says that more people are killed by soot than by motor cars, so that householders with coal fires are virtually committing suicide and murder. The jay walker has only himself to thank in the majority of cases.

My house stands on high ground about 5½ miles by road from Leeds, and motoring down in the mornings, when one comes within a mile or so of the centre of the town, down the hill, there is always the old smoke pall over the city, and this is the air which we unfortunate people working in the city have to breathe every day.

At the Headingley Football Ground, Leeds, on Saturday, I happened to find myself with three doctors, and at the time the wind was blowing straight into the stand and the ground was bathed in smoke—due to the fact that the wind was coming from the direction of the congested area of Leeds.

I pointed this out to one of the doctors, who said: "I will write you a letter;" and I think it will be interesting if I read you an extract from his letter:

> "I have looked up some of the literature on smoke abatement, and all angles seem to have been viewed.
>
> For 12 years I have been a Public Assistance Medical Officer, and have been amazed at the number of damaged lungs among the people on relief. Over 50% of the permanent relief cases suffer from some kind of chest trouble.
>
> Sometimes I wonder that the authorities have not realized that the smoke nuisance in damaging lungs is causing pauperism and a heavy expense to the State—
>
> (*a*) Relief.
> (*b*) Medicine.
> (*c*) Hospitals.
>
> Badly burned coal will fill the atmosphere with the ideal materials for causing cancer of the lungs.
>
> At birth, the normal lungs are salmon pink in colour. In the post-mortem rooms of the cities all lungs are found to be dark grey or black. On cutting, you can feel the grit, and the knives are blunted.
>
> People come into the surgery and ask for a cure for catarrh. I tell them to live in a cleaner atmosphere."
>
> (But how can they?)
>
> "Solve the smoke nuisance problem and you can shut up the artificial sunlight clinics and a certain portion of the hospital wards—also a few soap factories."

When I was in Norway I was actually told that the smoke from the North-East Coast could be traced on to the cliffs of their country! Sir Philip also says that the domestic coal fire has lost little of its popularity; this is also my opinion, as the majority of people I talk to—while agreeing with smoke abatement—say, "But I do like my coal fire," and it is this one coal fire in every house that causes the trouble.

I am delighted to hear that the Samuel Commission is looking forward to the day when it will be possible for the Government to prohibit the use of coal or penalize its users by the imposition of a special tax. I am sure that if this came about, all gas undertakings would give special terms to the all-gas houses. It is all rot to suggest that a coal fire is necessary. It is true I am in the fortunate position of having free gas, but I have not used an ounce of raw coal in any of the three houses I have lived in in Leeds during the last twenty years.

Leeds has recently embarked on a very large slum clearance scheme, and 31,000 houses are being built. The Leeds Corporation are encouraging their tenants to use smokeless fuel. The Gipton and Seacroft Estates alone, when finished, will comprise upwards of 15,000 houses which are situated all round the Tuberculosis Hospital that has recently been extended at a cost of £33,000.

Every house in these estates is fitted with a treble purpose range for heating the room, water, and oven, the one fire doing the three operations. This fire is designed exclusively for burning coke, and although the Gas Department have guaranteed that the cost of coke should not be increased—and we still supply and deliver bags of approximately ¾ cwt. for 1s. 1d. (which, having regard to the present price of coke, is very cheap)—we find that over 90% of the tenants of these houses to-day are burning coal. This is in spite of the fact that the cost of using coke is about 5d. per day, while coal is twice as much. And so the smoke pall over these estates is really alarming; but for the fact that these houses are built 14 to the acre, instead of being congested and "back-to-back" as in the past, the smoke pollution in this area would be just as bad as it was in the centre of the industrial area.

From the foregoing it will be seen that nothing short of legislation will cure this curse.

Need for Great Effort.

Dr. W. DAVIDSON (Radiation Ltd.) said Sir Philip Dawson had given them some astounding figures as to the damage done by smoke which clearly demonstrated the need for a great effort to obtain the abolition of smoke. They were all agreed the British public was firmly attached to the solid fuel fire, and it appeared to be essential to provide a smokeless solid fuel fire. It was suggested, therefore, that the gas-ignited coke burning appliance offered the most promising solution to a large part of the problem. The Gas Industry had already made a very substantial contribution towards the elimination of smoke by supplying a considerable quantity of coke for burning in the complete series of heating and cooking coke burning appliances which could now be had. The substitution of coal by coke for the domestic appliance had, however, only commenced, and the task which lay before the Industry and the appliance makers was a very great one.

"I should like," he said, "to make a plea for the closest co-

operation between gas undertakings and appliance makers in their work to obtain the ideal solid fuel and the ideal appliance for burning this fuel.

"How can we define the ideal solid fuel? It should be smokeless, easily combustible, clean, dry, correctly graded, and dense. Considerable progress has been accomplished, and each year brings further improvements in the quality of the coke offered to the public. Much research has been carried out to discover the best carbonizing conditions and the most suitable blends of coals."

Increased reactivity of the coke had been obtained by the blending of the coal with "activators." A most excellent coke had been obtained by carbonizing uncrushed nut coal in 14-in. coke ovens using a flue temperature of 1,000° C. This coke possessed great advantages over that made from crushed coal or uncrushed 0-2 in. coal and was more combustible, much denser, contained no fine ash, and burned with greater efficiency. Similar results would no doubt be obtained by carbonizing uncrushed coal in retorts. The problem of supplying good smokeless fuel bristled with difficulties, since the domestic market, although the most remunerative, was undoubtedly the most fastidious. He suggested the Gas Industry should collaborate with the appliance makers in their work on the improvement of coke quality. The Gas Engineer would not only obtain exact guidance as to the suitability of the coke for burning in domestic grates but the appliance maker would in this way be kept informed of the alterations of coke quality and this would greatly assist him in his research on appliance design.

Mr. WILL THORNE, M.P., said he understood the engineer from Leeds to say there were a number of chimneys emitting smoke continuously; but he should know perfectly well that the local authorities had power to abate such a nuisance. If a note were sent to the Medical Officer of Health he could compel them to abate the nuisance or they were liable to be prosecuted. He suggested that complaints should be lodged with the local authority.

Mr. A. W. SMITH said they had to be realists, and although it was said there was legislation for tackling smoke from factory chimneys, that did not touch the domestic smoke problem. The quantity of coal sold in Birmingham in one week in the winter was 20,000 tons. It was a fine market to go for, but they had to give consumers something that was equal in efficiency, comfort, and cost. It was up to all of them to develop that market. They could not do it with all-gas houses. They had to provide solid smokeless fuel which was just as acceptable to the householder and they had to provide facilities in regard to deliveries and price. They had spent a lot of money and time on this matter in Birmingham, and in the last two years they had installed well over 15,000 of the special coke grates, and every time they had an exhibition locally they sold more and more. "You cannot expect the public," he said, "to be altruistic but if you can produce something acceptable to them and which costs no more you will find them ready and willing to patronize your wares."

Vote of Thanks.

Councillor W. P. JACKSON (Manchester) proposed a vote of thanks to Sir Philip Dawson for his Address. This problem was one which caused deep concern, and they regarded it not only from the point of view of the Industry, but from the point of view of public health generally. He felt with others that this problem could only be solved by legislation—he was not sure whether or not it would be by prohibiting the use of raw coal. Recently he went into one of the upper rooms of the Manchester Town Hall and he was amazed by the sight of the large number of smoking chimneys within a radius of half a mile. It dawned on him then how the professional classes, solicitors, and lawyers still stuck to coal fires in their offices. There were a large number of these near the Town Hall. They had no power at present to compel them to change, but in the summer Manchester was going in for an intensive campaign to change the fires to coke or gas in the centre of the city. He hoped there would be legislation in the near future. When the Government had settled their own national difficulties and the national difficulties of other countries perhaps they would find time to deal with this important problem.

Mr. R. J. ROGERS, in seconding, said they had been told of the effects of smoke on health, and he thought more educational work of this kind was necessary to convince the public as to what could be done by the adoption of satisfactory appliances using coke or gas to combat the problem. In his opinion sufficient educational work had not been done by national and local government authorities. This subject had been investigated by commissions and nothing had been done in the way of legislation. He urged something might be done to give a lead through national and local government departments to the citizens who were still using coal. He suggested seriously a lead might be given in this direction. Professional men had been mentioned, and again this was largely a matter of education. There was no excuse that appliances were not available or that the cost was prohibitive. On behalf of the S.B.G.I. he would like to say they were willing to collaborate in the production appliances for use with coke or gas.

LUNCHEON.

Subsequently members of the Conference were entertained at luncheon under the chairmanship of Lord Dudley.

In proposing the toast of "Our Guests," Lord Dudley called attention to the importance of research and of scientific development generally in the Gas Industry. He had recently travelled in many parts of the world and visited countries which were our great competitors in industry, and there he found that research had developed to a very much greater extent than they found it existing in this country. Those countries had not had the same post-war difficulties as we had experienced in the ten or fifteen years after the war when, literally, we had no money to spend on industrial research. In America they could afford it to a much greater extent than we could. That should not be so. If individual industries were not considered to be spending sufficient money on this important aspect of their work, then, in his opinion, there should be statutory means to force them, and, if necessary, statutory assistance.

Sir FRANCIS JOSEPH (Past-President of the Federation of British Industries), responding to the toast of "The Guests," said, as a business man, and one touching the industrial life of the country at many points, one of the outstanding successes, not merely of to-day, but of the post-war years, had been the courage and resolution with which the Gas Industry had faced competition, and created demand when every indication pointed to the fact that it might go elsewhere. They had retained their position, and they had done it with dignity, with ability, and with the application of a knowledge which reflected great credit upon the Industry and those engaged in it.

"I do not believe," Sir Francis said, "that the heavy British industries have ever put up a show equal to the show in this Fair. It is, I believe, the answer to the world that there is a quality to-day in British skill and craftsmanship that can make a contribution to the life and well-being of the whole civilized world, which is there for the asking. I am glad to think that we are not merely leading in craftsmanship, but that there has been a helpful and in many cases a dramatic change in our craftsmanship. The old attitude of 'take it or leave it' of the British manufacturer has gone, and gone for ever. British manufacturers are out to give the world what it wants, and give it on such terms as will attract custom from the rest of the world."

He admitted frankly that there had been a change in the last six months as to the outlook for the future course of trade. "That was due to the fact that there was a native caution in British industry which said, in good times, 'We must be prepared for a change for the worse.' During 1937, by reason perhaps of the armament programme, and of the revival of confidence, not merely at home and in the British Empire, but in most other countries, demand increased to such an extent that prices soared and demand overtook supply. Then came a change. America, largely by reason of political troubles, found itself with a setback. There were tremors in Europe and there were explosions in the Far East. The lag in delivery shortened, and production overtook all possible demand.

"So we said to ourselves: 'Bad times must be coming;' but, as business men, let us look at the balance-sheet of John Bull, Ltd. Week after week, when we examine the revenue returns, we find that millions are being taken out of the pockets of industry and paid into the Treasury; but from the figures of the revenue returns, we know that the results of British industry during the past year have not only been good but have marked a level of prosperity that makes us the envy of the world. We find to-day that more men are employed in industry than there were twelve months ago. More than five million people secured wage increases during 1937 amounting to £31,000,000 per annum and we know that more than 3,000,000 of our workers have secured holidays with pay."

They found that the fears of war in Europe were slowly subsiding, and they found that the needs of the world were great and that there were empty shelves everywhere which British production and salesmanship could fill. The British market was still the best market in the world for primary producing countries. To-day Britain was sound financially in every respect and he believed that if they, as industrialists, could show in their activities the same example as was shown by the British Gas Industry, greater prosperity and greater contentment for our people would be assured.

CONCLUDING BUSINESS.

The Joint Gas Conference concluded on Thursday, when, after a display of propaganda films in the morning, the delegates were entertained at luncheon by the Birmingham Chamber of Commerce and the Fair Management Com-

mittee. The chair was occupied by Mr. Geoffrey Burton, and among those present were the Master Cutler of Sheffield (Col. H. A. Neill), the High Commissioner of New Zealand (Mr. W. J. Jordan), and the Agent-General for Western Australia (Sir H. Colebatch).

In welcoming the delegates, the CHAIRMAN said he was delighted to see so many members of the Gas Industry present that day. As representing the Birmingham Small Arms Company he felt he had a close connexion with the Industry. The Company had factories in various parts of the country and last year they paid the Gas Industry £42,000. As a member of the Council of the Birmingham Chamber of Commerce he was glad to welcome the Industry because it was a strong supporter of the B.I.F. and also because he had a great admiration for the serious way in which they took their responsibilities as a public utility organization. He knew of the great efforts that had been made, with excellent results, to reduce the real costs of gas in its manufacture. Not only that, the Industry was always ready to co-operate with consumers, not in trying to get them to buy more gas, but in helping them to use it economically. Recently he had an instance in his own works, where with the kind co-operation of one of their gas engineers, by a simple modification of a certain heat furnace, they reduced the consumption of gas by 25%.

The HIGH COMMISSIONER OF NEW ZEALAND said his country wanted trade with Great Britain and they considered the mark "British Made" to be the hall mark of quality in manufacture. They wished to continue to buy from Britain, but their fear was lest the British Government insisted that there should be a quota of produce landing in this country. Then New Zealand would be compelled to seek other markets.

Mr. H. C. SMITH (President of The Institution of Gas Engineers) said the Gas Industry had had to fight very hard in the last few years, and they had certainly not reached the end of the struggle or the peak of accomplishment. They had got to fight much harder yet, and those Conferences held at the Fair were one example of the way in which they could fight effectively. It showed that all the interests in the Industry could get together and show a united front. They had to fight to ensure that coal in this country was dealt with in the most efficient manner. Every piece of legislation that they had had recently was designed, as far as he could see, to waste coal. That might be all right as a temporary measure, but the Gas Industry was the one industry that could deal with coal efficiently. They had a co-ordinated Industry and they could show an example to many other industries. They co-operated in staging that exhibition. It was true the major part of the work was done by the manufacturers of appliances and not by the supply side, but they had to co-operate in that way and he hoped the time was approaching when they would co-operate in regard to research and selling methods. He expressed cordial thanks not only for the hospitality that had been extended to them but also for the facilities that had been given them for holding their Conference.

Col. H. A. NEILL thought that industrialists throughout the country owed a great debt to the Birmingham Chamber of Commerce for organizing the Fair.

Coal Carbonization and Its Importance in the Life of the Nation

By E. V. EVANS, O.B.E., F.I.C.,
General Manager of the South Metropolitan Gas Company

A Lecture delivered at the Royal Society of Arts on Wednesday, March 2—Mr. FRANK HARDING JONES in the chair.

I propose to place before you in the course of the next forty-five minutes or so some facts to show the present importance of the Gas Industry to the nation, to show also that the work of that Industry in contributing to the national welfare merits wider recognition, and, finally, to give some indication of the possible lines of development of the Gas Industry. In presenting this case it will be necessary to make comparisons with other industries that undertake the supply and treatment of fuel. I have done my utmost to prepare a case which shall be as free from bias as possible, but it must be understood that I am intimately associated with the Gas Industry. This is an important matter for, however disinterested I have tried to be, the fact does remain that I have spent my life in that Industry and have watched with the closest interest its development from year to year.

This platform has often been used for the discussion of fuel problems. So late as last year Captain Dickie pressed strongly for further examination of the possibility of the production of oil from coal in this country, while, a few weeks after, Professor Nash extolled the present practice of importing our oil requirements and criticized the high cost of processes for the home production of liquid fuels. A Parliamentary Committee has recently reported upon the question of oil production, but this particular problem, important though it is, is only part of the much larger question of the rational and scientific utilization of our coal resources.

Need for a Rational Fuel Policy.

It might seem almost a waste of time in this 1938 to stress the need for a comprehensive national policy for the use of fuel, for so much has been said upon this subject and, indeed, much has actually been achieved. There remains, however, still a good deal yet to be done, and I suggest to you that the rationality of some proposals has sometimes been obscured by misguided enthusiasm.

The coal and oil deposits exploited for our use to-day are the accumulation by nature over millions of years. It is only some 150 years since we started dipping into the treasure hoard of coal and some 70 years since the oil deposits were first tapped, yet already the winning of coal and oil is becoming noticeably less easy. It is not proposed to use any of the estimates, which vary so widely, of the possible life of the world coal and oil resources. Perhaps it will be sufficient for the purpose to say that the probable life of petroleum deposits at the present rate of expenditure is materially less, perhaps only one-tenth of the life of coal deposits. It might be said generally that the existence of the world's oil resources could be expressed in decades as against the life of coal which is to be reckoned in centuries. However fictitious all time estimates may be, it is indisputable that the rate at which we are using coal and oil is immeasurably greater than the rate at which they were formed.

In which direction the generations of the future will look when fuel resources become seriously depleted is not subject matter, at the present time at least, for discussion before this Society. Whether inventors will rely upon the tides, or wind power, or the internal heat of the earth, or will direct their energies to cultivating bacteria for the production of liquid fuel from the vegetation of tropical and sub-tropical lands, is just at the present moment a matter of agreeable conjecture. I am sure you will agree that at the present time all efforts should be made to use wisely that which we have.

It is unreasonable to imagine that, with to-day's growth of mechanical invention and with the greater amenities and comforts that are associated with our lives, the fuel requirements of the individual will become less. Rather is it to be expected that the problem of fuel conservation will become year by year a more pressing one and particularly will this pressure arise in connexion with liquid fuel, the consumption of which is increasing more rapidly than that of coal notwithstanding the fact that the reserves appear to be lower than those of coal.

These questions of coal conservation and of the production of oil from coal are not merely aspects of a policy of economic nationalism (here I use a term which is employed to describe one of the features of the policy of the so-called totalitarian states), nor should they be considered solely by reason of the need for ensuring national safety in face of the present politically disturbed condition of the world. I think it is of international importance that those nations such as ours who find themselves in control of great fuel resources must regard themselves as trustees whose duty it is to ensure that these resources are utilized to the best possible advantage.

In making now a slight digression I am not attempting to extol the political reasoning which lies behind the efforts of Germany to make herself self-supporting in oil supplies, but one cannot but admire the technical ability and courage which are being displayed in constructing in that country a national fuel policy by which the whole requirements of solid, gaseous and liquid fuels will be derived from indigenous sources. Germany, as you know, is not well provided with rich coal, for a considerable proportion of her coal deposits is of the geologically young variety known as lignite. While this material is easily mined it contains as much as half its weight of water and has a calorific value of just over

one-third of that of our English coal. Despite this, Germany expects by 1940 to be self-supporting in the matter of liquid fuel. As an example of what is being done, I would cite one district in Germany where two fuel processing plants have been erected adjacent to lignite deposits. One lignite is more suitable for carbonization than the other and low-temperature carbonization is practised. The tar from this is hydrogenated to liquid fuel. The solid residue is used partly in electricity generating stations and partly for the production of hydrogen for the treatment of tar. In the treatment of the other lignite, which is poorer in quality, some is used for the generation of electricity and some is briquetted and provides solid fuel for use in homes and on railways. Another portion of this poorer lignite, less suitable for briquetting, is completely gasified by a recently developed process employing oxygen and steam under a pressure of 25 atmospheres and the gas so made is supplied to local gas undertakings. This is only a bare outline, but even although the procedure adopted in this district would not necessarily be applicable elsewhere, a detailed description of what is being done would be of great interest to the rather spoiled inhabitants of this country. For it does illustrate what may be done when a serious attempt is made to deal in a scientific manner with the fuel resources available. It has ben said that it is the aim of scientific agriculture to make two blades of grass grow where one grew before, and I suppose it is the purpose of a rational fuel policy to ensure that two tons of coal are not consumed if the same effect can be obtained by the use of one ton. There may be those who fear the displacement of labour in the coal mining industry by the operation of such a policy and the reply to such must be that the displacement would be a gradual one which would enable the transfer of the workpeople to other, and, I think, more congenial tasks than that of coal mining.

I do not wish to spend more time upon the very contentious matter of the expectation of life of our present coal and oil supplies, for it has been generally agreed for many years that we should conserve those resources, and I would proceed at once to develop the case that both the carbonizing and the electricity generating industries to-day make a valuable contribution to the conservation of our resources, that they are essential to a sound system of fuel utilization, and that they should be more complementary to each other and less competitive. Both industries supply necessities of life and the operations that are undertaken by one or other of them should be regulated by reference not only to the requirements of fuel conservation but also to national economics in their widest sense. In order to develop this point it will be necessary to deal briefly with the achievements and developments of the two industries.

The Value of Carbonization.

It is a fact that in every practical use to which coal is put a proportion, sometimes a large proportion, of the available heat is not utilized. Coal used in the open fireplace puts into the room which it is desired to warm about 20% of the potential heat of the coal. Now one of the causes of this low efficiency is that in the same appliance we are attempting to burn gaseous, liquid, and solid fuels simultaneously and a further complication arises from the fact that the three phases are changing continuously. The end that is achieved by the carbonizing process is the separation of these three phases before combustion in order that they shall be utilized in apparatus and under such conditions that their individual properties are developed to the best advantage.

In the Cantor Lectures which I had the honour to deliver many years ago a fair amount of time was given to the question of the possible distribution of the thermal energy of the original coal to be achieved by various carbonizing processes. The most widely accepted practice in the Gas Industry to-day is to distribute the thermal energy of the original coal into coke, gas, and tar in the proportion of 70, 25, 5. Now of the 70 units of coke, 23 are used in the process of carbonization and thus for every 100 heat units in the original coal 47 are recovered as coke, 25 as gas, and 5 as tar, a total of 77, and this figure of 77 is accepted as the thermal efficiency of the carbonizing process. The final question that we have to ask ourselves is whether the enhanced efficiency of these separated products is so much greater than when the raw coal is used that it more than pays for the loss of 23% of the heat of the coal, together with the cost of the carbonizing process. In the large number of processes and operations in which coke or gas is used at present the answer is definitely affirmative.

Knowing that the thermal efficiency of the process is of the order of 77% it might, at first sight, appear that coal has not been saved, but we must remember the fact that carbonization is carried out in order that the products obtained shall lend themselves to a greater efficiency in use. When gas and coke are used for domestic purposes (and some 80% of the gas manufactured in the country is used for domestic purposes), it may be accepted that in effective efficiency 1 cwt. of coal is equivalent to 5 therms of gas or 0·89 cwt. of coke, and calculation would show that we have obtained the equivalent of some 400 therms in place of the 300 therms with which we started and which is the approximate heating value of 1 ton of coal. In addition to this, 10 gallons of tar and a quantity of sulphate of ammonia have also been obtained. It must not be forgotten that besides this enhanced thermal economy a great social benefit has been simultaneously obtained. Had the raw coal been burnt directly, not only would one-third as much again have been required, but a considerable proportion of the tar, and all the sulphur recovered in the form of sulphate of ammonia, would have been discharged into the atmosphere.

The extent to which carbonization of coal is carried out for the purpose of separating its constituents into more readily usable forms may be gauged by the fact that the Gas Industry of Great Britain carbonized in 1936, 18,334,000 tons of coal, producing 12,286,000 tons of coke, about 310,000 million cu.ft. of gas together with over 200 million gallons of tar and some 86,000 tons of sulphate of ammonia. These figures taken by themselves are not really entertaining; perhaps their magnitude will be better conceived by telling you that the coke produced alone was equal in its thermal value to the whole of the coal used by the railways of Great Britain, and the amount of sulphate of ammonia produced was sufficient to fertilize a cornfield the size of Lincolnshire.

It must be remembered that the Gas Industry is not the only industry which makes use of the process of coal carbonization, for an equal quantity of coal to that treated by the Gas Industry is carbonized in the coke ovens which form an essential part of the iron and steel industry. Part of the gas produced is used for heating the ovens themselves and a considerable proportion of the remainder is used for the many heating operations required in the iron and steel works to which the coke is supplied, while a proportion of the gas (some 11%) is supplied to gas undertakings for re-sale to their domestic and industrial consumers. Thus, taking the two carbonizing industries together, there is a total of over 39 million tons of coal treated annually by this process of carbonization and this quantity represents 22·2% of the total quantity of coal available for home consumption in 1936.

Post War Planning.

Having dealt briefly with the purpose of the carbonizing industries, it becomes necessary to survey the general problem of fuel utilization in order that the several coal processing industries may appear in their proper perspective. In 1918 the Ministry of Reconstruction appointed a Coal Conservation Committee to advise upon the use of our fuel resources to the greatest advantage of the community. That Committee divided itself into a number of sub-committees and the reports of the Power and of the Carbonization Sub-Committees are of great importance. The Power Committee had been impressed by the tremendous waste of coal which was then taking place by the generation of mechanical power in small and scattered units. They estimated that, of the 189 million tons of coal used for home purposes in 1913, at least 80 million tons were absorbed in the production of power, and it was known that many isolated power units of that time could not show a thermal efficiency greater than 5%. I think it will be generally agreed by those who were watching affairs at that time that there was an urgent necessity to develop power centrally and to distribute it for use to those points where so much coal was being wasted. The Committee naturally looked to large steam units for the production of mechanical power. Owing to thermodynamic limitations the transformation of heat energy to mechanical energy is necessarily a process of low efficiency and, of course, always will be. In order to prevent its being wastefully low it is important that power generation should take place in well-designed and well-controlled, large units. The Committee realized that power is not always required for use at the point where it is generated and sought an efficient means of transmitting the power from the central stations to the points at which the power was required. The obvious means of such transmission lay in converting the mechanical energy at the power station to electrical energy, transmitting the electrical energy, and reconverting it where required to the form of mechanical energy. In this way it has been possible to achieve a thermal efficiency of some 27% in converting heat energy to mechanical energy, while the transmission of this mechanical energy, through the agency of electricity, can be accomplished with an efficiency of some 75%. It follows, therefore, that an overall efficiency of heat to work of 21% may be achieved. At the time that the Committee reported the electrical industry of this country was not in a position to accept this heavy responsibility. In fact, its own efficiency of power production in 1918 was only 8·49%. Moreover, the generation and distribution of electrical energy were controlled by so many different authorities, that it is said that in the Metropolitan Area alone there were seventy undertakings distributing electrical energy at twenty-four different voltages and ten different frequencies. Such a situation called most clearly for strong governmental action, and Electricity Commissioners were appointed to centralize the generation of power and its distribution in the form

of electrical energy. It was from this seed that the great electricity development of recent years has grown.

It is interesting also to follow the recommendations of the Carbonization Sub-Committee. While they commented upon the reasonable standard of efficiency that was then being obtained, they saw the possibility that in the future this process would utilize to a much larger extent coals that were then consumed in the raw state. Carbonization, they said, would render available for use inferior coals, shales, and duff which were then regarded as waste, and would add to the home supplies products of carbonization which at that time were being imported. Actual reference was made to fuel oil for the navy, motor spirit to be used in transport, and the raw materials for the production of explosives, dyes, and drugs. It was on the recommendation of this Committee that the Fuel Research Board was set up, and it is interesting to remember that, in its first report, the Board fully realized its responsibilities by outlining a programme intending to apply the process of carbonization to meet the needs for a home source of fuel oil, for the abolition of atmospheric pollution, and for economy in coal utilization.

Progress in Recent Years.

Since the publication of the report of the Coal Conservation Committee much has been done both in carbonization and in the transmission of power by electricity. The coking industry and the Gas Industry have made appreciable technical advances as a result of their own development work. The coke oven industry has more widely adopted regenerative ovens, which have set free larger quantities of gas for use in steel works and other industries. A modern iron and steel works is an excellent example of what may be achieved by the scientific study of fuel requirements. Not only is coke oven gas available for fuel purposes, but also blast furnace gas. The whole system involving solid and gaseous fuel and electrical energy is planned as one self-contained but flexible whole. Progress in the Gas Industry is best realized by the statement that had the methods of 1920 obtained in 1936 an additional 3½ million tons of coal would have been necessary to produce the quantity of gas that was actually supplied by the Gas Industry. At the same time the Gas Industry has given much attention to improvements in the quality of gas supplied and to the removal of such impurities as naphthalene and sulphur and to the efficiency of utilization of gas in appliances. Perhaps the most striking achievement, however, is the advance of centralized power production and its distribution in the form of electrical energy. The Electricity Commissioners have completely reorganized and modernized their system of power distribution. In 1917 it required on an average of 3·7 lb. of coal to generate one unit of electricity, and the Seventeenth Report of the Electricity Commissioners (1936-37) shows that only 1·48 lb. of coal is now required to do the same work. Having regard to the fact that the amount of coal converted to mechanical power by the electrical industry in 1936 (apart from railways and tramways) was 12,600,000 tons, the increased efficiency represents an economy of something like 17,000,000 tons of coal per year. Perhaps it is not surprising that the excellent results achieved by centralized power production and distribution of power as electrical energy should have led many to accept the view that an equally great advance would be made if electricity were adopted for all purposes.

Use of Electrical Energy for Heat.

The consumer of electrical energy, perhaps not unnaturally, is apt to regard the energy he receives as a very convenient and highly refined form of fuel and not, as it truly is, a means of transmitting mechanical power. Indeed, the consumer is often encouraged to use electricity for all purposes by the form of his supply contract. It is recognized that in converting heat energy to mechanical energy, it is necessary to sacrifice something between two-thirds and three-quarters of the heat energy of the coal, and it is important to note that this loss arises, not from any lack of technical skill, but through the operation of thermodynamic limitations. Surely the very last purpose to which such energy should be put would be reconversion to the low grade heat energy from which at such cost in fuel and money it was obtained. Would it be a defensible proposition to burn coal for the production of steam, to supply the steam to an engine, to cause the engine to turn a shaft, and then to apply a brake block to the shaft so that the friction between the brake block and the shaft might generate sufficient heat to warm one's home or office? Yet that is in effect what is done when the energy of coal is converted into electrical energy which is then used for heating purposes.

In spite of these well-established facts there is to-day a widespread belief, which has received considerable Government backing, that the way to a fuel Utopia is along this tortuous path. In actual fact such a policy would completely undo all the excellent work that the centralization of power generation has already accomplished.

A statement of this importance requires some amplification, and to do this it is necessary to depict in a general way what large quantities of coal would be required, how much capital would have to be available, and how costly it would be to the consumer if in the years to come domestic heating requirements were supplied largely by means of electricity. We have already considered the thermal efficiencies of the two processes, carbonization and power generation, and 77% has been given as the thermal efficiency for the gasmaking process and 27% the efficiency of the power station. It may be taken that there is practically no loss in the transmission of the heat of gas and coke to the domestic premises and thus 77% is the overall efficiency. In the case of the transmission of electrical energy about one-seventh disappears and the overall efficiency of this procedure is reduced thereby to 23%. It is now necessary to set against these thermal efficiencies of production and distribution some figures indicating the efficiency with which the distributed energy is utilized in the appliances available.

There has been a great deal of work done both in this country and abroad in an endeavour to establish a just basis of comparison, and it would be very wearying for you to listen to a recital of the detailed figures. For those who wish to examine the evidence in detail there is a comprehensive summary of the data available in a Paper communicated by Masterman to The Institution of Gas Engineers in June, 1937. From this data, and from experience in practice, it can be accepted that for domestic heat requirements, comprising cooking, hot water, and the heating of rooms, 1 cwt. of raw coal can be replaced by 0·89 cwt. of coke, by 5 therms of gas, or by 100 units of electricity. These figures represent, as you will understand, relative efficiencies *in practice*. Now if these figures are used in conjunction with the production efficiency figures already quoted—namely, 77% and 23% respectively for carbonization and electricity—it is possible to obtain a new and comprehensive figure which relates the service obtained to that obtained from a ton of raw coal. This may conveniently be termed the raw coal equivalent. Expressed in this way the raw coal equivalent of the two processes is 1·313 for carbonization and 0·816 for electricity used as heat. The difference between 30% economy and 20% loss would represent the treatment of 10,000,000 tons of coal per annum more than is at present used in the Gas Industry if the same amount of domestic heating were achieved by electricity instead of gas. It is appreciated that the Gas Industry uses a caking coal and the electrical industry a steam raising coal of lower calorific value and higher ash content. There is, however, a limit to the supplies of this lower quality of steam raising coal, for it would not be mined for its own sake.

The case is not complete, however, until we have considered the relative cost of processing. I do not propose to calculate the total capital cost which would be incurred by any scheme for supplying the bulk of domestic heat electrically, but I leave you to draw your own conclusions from the following facts. The three Metropolitan Gas Companies, employing a total capital of £59,000,000, produce gas and coke equivalent to 6,230,000 tons of raw coal (raw coal equivalent) while the Metropolitan Electricity Companies with a capital of £63,500,000 generate and, in part, distribute 5,000,000,000 units equivalent to 2,500,000 tons of raw coal if used for domestic heating. The comparison is particularly favourable towards the electrical undertakings, as only some 20% of the energy generated is distributed direct to the consumer, but even so the capital expended per equivalent ton of raw coal is 2½ times as great for the Electricity Companies as for the Gas Companies. Provision of capital for an essential industry is not a problem in itself, but it is important to remember that a return on that capital has to be provided out of the pocket of the consumer.

A comparison of cost to the consumer is complicated by the different systems of charging for gas and for electricity, but a valid comparison may be made between the electrical commodity price of ½d. per unit and the commodity price which would be charged for gas under a similar system of charge. In London the commodity price for gas would lie between 4d. and 5d. per therm. Taking the higher figure it will be seen that a unit of useful heat is twice as costly when obtained electrically as when obtained by gas. (In order that the argument may be followed, it is necessary to remind you that in practice one therm of gas is equal to twenty units of electricity and thus if a therm of gas costs 5d., the equivalent price of electricity would have to be 1/20th of 5d.—namely, ¼d.)

Possessing, as the carbonizing process does, so many advantages, the question will naturally be asked—How has the electricity industry been able to acquire any domestic heating load at all?—and the answer to this question might well be that in the matter of pricing policy the Gas Industry has failed to keep abreast of present-day needs. Commendable though the achievements of the electrical industry have been in the matter of their contributions to the problem of cheap mechanical energy, the evolution of their two-part tariff deserves the highest commendation.

Method of Charge.

Considering its title it would seem that the question of the method of charge is a matter beyond the scope of this lecture.

It is, however, necessary to the case as the whole subject of fuel economy may be distorted unless the economics of the situation are seen in their proper perspective. It is the duty of a public utility undertaking to provide plant for the manufacture and distribution of its commodity for the use of any citizen who desires to avail himself of this service. The provision and maintenance of this service, as distinct from the commodity itself, involves considerable expenditure which must be recovered in the charges made by the undertaking, but the method of recovering this service cost varies.

In the case of a commodity such as water a person connected to the mains may pay a certain fixed sum only and, within certain limits, use the commodity freely. This method encourages waste because care in use does not reduce the cost to the individual.

The Gas Industry has for many years adopted the principle in which the commodity may be sold by meter and such a price charged for each unit registered as will, on the average, reimburse the undertaking for the cost of both service and commodity. Now this method restricts the free use of the commodity, because the price includes a contribution towards the cost of service, and an extensive use of the commodity means the payment of a heavy service charge out of all proportion to the value received by the individual consumer. At the same time the user of a small quantity of the commodity obtains greater value than he pays for.

More recently a third system has been introduced in which the essentially dual nature of the cost to the undertaking is recognized. The consumer is asked to make a fixed periodic payment to cover the service charge and to pay separately for the commodity according to the quantity taken. Such a system enables a consumer to make a limited or free use of the commodity according to his needs and inclination without unreasonable cost to himself and at the same time paying his share of the service cost. The electricity supply industry operates largely under this system and often with the paradoxical result that the dearer commodity, electricity, if used extensively, actually costs little more than the cheaper commodity, gas.

A very confused position has arisen to-day between these two great industries each providing an important public service and each anxious to add to the part it plays in promoting the common good. There is a great field for the expansion of the electrical industry in the wider provision of mechanical power for saving work, and adding to human physical comfort. That portion of the domestic load which does not directly aim at the supply of heat can, with great national advantage, be taken by electricity, but there has arisen a high degree of overlapping and competitive effort, and the public interest is already suffering.

In recent years the Gas Industry has made an effort to adjust its pricing system to accord better with present-day conditions and one of the large London gas companies is now offering gas for domestic use at the low commodity price of 4d. per therm, while there is good reason to believe that a similar practice will become general in the future.

Some idea of the advance which becomes possible when a rational system of gas pricing is adopted may be gathered from the striking demonstration afforded by the model dwellings at Kensal House, where a complete smokeless fuel service has been provided for the tenants at a cost actually less than that of the raw coal they had formerly used. The smokeless fuel scheme of Kensal House includes a coke fire in the living room, and the solid fuel fire in the home of a Briton is going to be exceedingly difficult to displace. Nevertheless, it is difficult to conceive that, in the future, with gas available at 4d. per therm, the householder will for ever resist the temptation to abolish that extra work which even a smokeless solid fuel entails.

It is well to think for a moment of the trouble and unnecessary work which a solid fuel fire involves. First it is necessary for the consumer to remember to order new supplies before his fuel store becomes empty. The receipt of his order sets in motion the machinery by which the solid fuel is loaded into sacks, the sacks transferred to a horse-drawn or motor-propelled vehicle, which add to the congestion of the streets in bringing fuel to his premises. On arrival at the private residence the fuel is discharged to the fuel store, whence it is transferred in shovelfuls or by scuttle to the fireside and thence from time to time on to the fire. The next morning there is the inevitable aftermath of ashes to be removed from the grate and, in no small degree, from the furniture of the room. Even then the trail of labour is not completed for the disposal of the ashes involves additional cost to the local authority. If it were not so commonplace this complicated chain of trouble would seem an incredibly cumbrous method of getting warm. It is inconceivable that the citizen of the future will endure this any more than to-day we expect to fetch our water from the village pump. An increased and increasing standard of living is bringing with it the desire for greater comfort and less drudgery. The appreciation of the necessity for improving the national standard of health will require that pure air shall be available even to the town dweller, and one of the tasks that must be tackled in the next few years is the replacement of the thirty to forty million tons of raw coal which is used for domestic heating to-day. The provision of a practicable alternative is a social service of no mean order, and I suggest to you that if the service is to be performed without waste in coal, without extravagant capital expenditure, and at a cost that the householder can afford, carbonization is the only known process which can perform it.

The Gas Industry to-day provides gas and coke and the service rendered by these two commodities is not only highly appreciated but the combination of the two fuels may continue to serve the requirements of the public for many a year. When, however, gas is sold on a reasonable price basis the Gas Industry may be faced with the problem of producing a sufficient quantity of gas from a ton of coal without the production of an excessive quantity of coke. Processes do, of course, exist in which coal is gasified completely, but the gas so produced is of low calorific value, and contains little methane but much carbon monoxide. It differs widely in these respects from the type of gas generally distributed to-day and is less likely to give satisfaction in use. The Institution of Gas Engineers has therefore initiated research into the possibilities of treating coal by the new technique which employs pressures considerably above atmospheric.

This work has been proceeding for two years but is still in its infancy and it would be very unwise for me to allow my personal enthusiasm to mislead you. Most interesting and unexpected results have arisen from these investigations and large yields of methane and primary tars are foreshadowed, but as yet, of course, nothing is known as to the commercial possibilities of processes based on these experiments. The promise of technical advance is, however, very considerable and it is possible to envisage these new developments helping us greatly by permitting a wider range of coals to be used than those suitable for existing carbonizing processes, by simplifying processes of purification, by increasing our control over the quantity and quality of the products, and perhaps by leading to new developments in high-pressure storage and distribution.

Whether the technique of high-pressure working is finally adopted commercially or whether the next advance will be made by the use of other methods, I am certain that we have to visualize the cities and towns of the future as receiving all their raw coal at the fuel processing stations. Such stations will convert the coal to electrical energy, to gas and to liquid fuels, and will be worthy objects of civic pride both in their appearance and for their function. Atmospheric pollution will have ceased and every home will receive its fuel supplies by pipe and wire, the two services co-operating to meet the public requirements. Coke will still be needed for metallurgical purposes and in its production tar, as we know it, will be produced at the coke ovens, but the supply of fuel in its refined forms will be recognized as being as socially important as the supply of pure water and the removal of sewage.

Perhaps I have been a little unwise at the end of this lecture in allowing my statement of the case and the recital of facts to develop into speculation upon the unattained and the possibilities of the future. Yet it is done with a specific purpose, and that purpose is to show that the Gas Industry, with its great record of public service, has an immense future before it. It possesses a century's experience, it has an army of willing and contented workers, including able technicians, alert salesmen, and experienced leaders. Its product is already supplied daily, even hourly, to some ten million homes. If we courageously adapt our methods of sale and manufacture and our appliances to modern needs, the way will be opened to a field of service greater by far than that we already know.

Scottish (Western) Juniors

Annual Whist Drive and Dance

Eighty members and friends of the Scottish Junior Gas Association (Western District) met at the Georgic Restaurant, Glasgow, for the Association's Annual Whist Drive and Dance on Feb. 26.

The President, Mr. R. A. MacLaren (Newton-on-Ayr), extended a hearty welcome to those present, adding that he hoped everyone would have an enjoyable evening. Mrs. MacLaren, wife of the President, presented the whist prizes. Following the presentation of prizes, Mr. J. Webster (Port Glasgow), immediate Past-President, said that it was his pleasant duty to hand over to Mr. MacLaren the Badge of Office. In reply, Mr. MacLaren said the Badge would remind him of one of the happiest years of his life. He said that to be President of such an Association was no small task. It was also his privilege to welcome a large number of new members.

Mr. W. Kirk, Secretary, then called on Mr. N. C. Sturrock (Greenock), President-elect, to give votes of thanks to Mrs. MacLaren for so gracefully presenting the prizes to the whist winners and to the Past-Presidents who formed the platform party. Mr. A. McDonald (Motherwell) suitably replied to the votes of thanks.

Gas Undertakings' Results

Brighton, Hove, and Worthing.

The Directors' report for the year 1937 shows that, while the annual sale of gas by the Brighton, Hove, and Worthing Gas Company shows a small decrease of 0·41%, when compared with the previous year, consumers have increased in number by 2,285, and the demand for gas appliances continues in increasing degree. Out of a total sale of gas of 15,459,160 therms, no less than 13,756,616 therms were taken by private consumers. In the Balance-Sheet, stoves, &c., on hire-purchase (less reserve) figure at £136,684. After charging the Revenue Account with an appropriation of £8,000 for the Special Purposes Fund, the profit for the year amounts to £139,652. Adding to this the sum of £48,100 brought from the previous year, there is a total of £187,752. From this, £11,000 is transferred to the Contributory Pensions Fund, and the costs of the Company's Special Act last year (£2,075) are deducted. The sum of £133,930 remains available, and after the dividend appropriations, and the transfer of £3,500 to the Reserve Fund, there will be a balance of £44,711 to carry forward. The dividends recommended for the year are 7½% on the 6% standard consolidated stock, and 6¼% on the 5% standard consolidated stock. The Capital Account shows a credit balance of £54,395. During the year an issue was made of £45,000 of 4% perpetual debenture stock, and an amount of £31,650 of 5½% debenture stock was redeemed. An issue of £40,000 of 4% preference stock has been made since the close of the year, and the Directors are seeking authority from the proprietors to raise additional capital to an amount not exceeding £187,095.

Cleveland.

The Cleveland Gas Company, whose offices are at Skinningrove, Saltburn, Yorks., issue their report and accounts half-yearly, and out of the profits for the six months to Dec. 31 the Directors recommend the payment of a dividend at the rate of 2½% per annum, and that the sum of £350 be placed to reserve for repairs to plant. This will leave £2,835 to be carried forward, which is £33 more than was brought in. The Capital Account shows a balance of expenditure in excess of capital received amounting to £10,101. The quantity of gas sold in the past half-year was 15,210,600 cu.ft., or 69,969 therms, as compared with 14,492,100 cu.ft. in the corresponding half of 1936.

Eastbourne.

The report for the year 1937 of the Eastbourne Gas Company states that an agreement has been entered into for the supply of gas in bulk to the Heathfield Gas Company, Ltd., and that a trunk main is being laid from Horsebridge to Horam for this purpose, the cost of which will be borne by the Heathfield Company. A showroom, with offices and demonstration theatre, is being erected in the main thoroughfare of Seaford. The quantity of gas sold during the year was 3,354 783 therms. The dividends for the year are 8% on the "A" stock, and 6½% on the "B" stock, leaving a balance of £685 to be carried forward. The net addition to capital expenditure during the year was about £30,000, but there is still a balance of over £20,000 in hand, the Directors having issued last March £50,000 of 4% redeemable preference stock.

Lea Bridge District.

The Lea Bridge District Gas Company, an extended report of whose annual meeting will appear in next week's issue of the "JOURNAL," had a good year in 1937, the Directors stating that the sale of gas shows an increase of 1·58%, when compared with that of 1936. The actual quantity sold in the year under review was 1,104,795,000 cu.ft., or 5,523,975 therms. The net increase of capital expenditure during the year was small, and the balance at credit of Capital Account is over £82,000—£30,000 having been received from the issue of 4% redeemable debenture stock. The profit for the year as shown by the Revenue Account amounts to £34,505, and after the payment for the year of a dividend of 8½% on the consolidated ordinary stock, and transferring to the Employees' Pension Fund the sum of £2,000, there will remain to be carried forward a balance of £20,434. The balance brought into account was £22,523. Stoves, &c., on hire-purchase (less reserve) figure at £69,494.

Rochester, Chatham, and Gillingham.

As compared with 1936, the sale of gas during the past year by the Rochester, Chatham, and Gillingham Gas Company shows the satisfactory increase of 2·58%. The dividend for the year on the consolidated ordinary stock is 6½%, which will leave the sum of £18,825 to be carried forward to the credit of the current year. The only item of capital expenditure during the year was for new meters, and this was exceeded by the allowance for depreciation of meters. There is a balance at credit of Capital Account of £26,620. The total quantity of gas sold during 1937 was 1,083,189,476 cu.ft., or 5,145,150 therms. The balance of profit carried to Net Revenue Account is £40,971.

Sheppy.

An increase of no less than 9·23% in the sale of gas last year, as compared with 1936, is reported by the Directors of the Sheppy Gas Company, while 254 new consumers have been obtained. The total quantity of gas sold (which includes a small amount used in benzole extraction) was 206,109,580 cu.ft., or 963,057 therms. The dividend for the year on the consolidated ordinary stock is 5¼%, after payment of which a balance of £4,106 will remain to be carried forward to the credit of the current year. During the year there was a net addition of £6,404 to the capital expended, while on the other side the Company issued £52,280 of 4% perpetual preference stock, which leaves the Capital Account in credit by a small amount. The balance of profit carried to Net Revenue Account is £7,038.

Southgate and District.

The area of supply of the Southgate and District Gas Company continues to show satisfactory development—a gratifying state of affairs which is reflected in a substantial increase in the sale of gas of 5·27%, compared with the amount sold in the previous year. The dividend for the year on the consolidated stock (7% maximum) is 7%, and after transferring £1,000 to the Reserve Fund and £2,000 to the Pensions Fund, there will remain £8,916 to the credit of the Profit and Loss Account to be carried forward to the current year. The net capital expenditure during the year was £18,000, and there is now a balance at debit of Capital Account amounting to £31,445. The balance of revenue carried to Profit and Loss Account is £23,377. Stoves, &c., on hire-purchase (less reserve) figure at £22,445. On the other side of the Balance-Sheet there appears loan from bankers £54,000, but during the year £26,110 of 5½% debenture stock was redeemed. The Directors point out that the proposed transfer of the Company's undertaking to the Tottenham and District Gas Company (of which the proprietors have approved) is awaiting the decision of the Board of Trade.

Swindon.

In our news columns last week we were able to report the big War Office contract obtained by the Company—a success which will be universally acclaimed in the Gas Industry. This was, however, only the climax to a year of wonderful all-round progress which is announced by the Directors of the Swindon United Gas Company in their report for 1937. During the year 1,056 new and additional consumers have been added to the Company's books, bringing the total to 20,777, in addition to which a bulk supply is now being delivered to Highworth, Wootton Bassett, Fairford, and Faringdon Gas Companies, and the villages *en route* in the new area of supply. In these circumstances, all-round expansion is recorded. As compared with the previous year sales of gas show an increase of no less than 10·52%; and of appliances, one of 60%. There have been further concessions in price, and the Directors point out that the total reductions made in the price of gas during the last five years have cost the Company over £18,000 per annum, or more than is distributed by way of dividend. Of course, the increased sales have enabled this to be done. Indeed, but for the rise in the cost of coal, a still further reduction in gas prices would have been made. The Subsidiary Companies are making similar progress. The dividend for the year on the consolidated ordinary stock is 6%, the same as last year, which will leave £10,614 to be carried to next account. Naturally there was capital expenditure during the year, chiefly on mains and services, in carrying out this programme of expansion, and the Capital Account is in debit to the extent of £38,494. However, the Board of Trade have granted an application for increased capital powers, extensions of the area of supply, &c.

York.

The Directors of the York Gas Company report for the year 1937 a record output of gas, the quantity accounted for being 4,782,104 therms. York promises to become quite a "show place" for the Industry by reason of the excellent display of gas lighting now in process of installation at York Station. It is claimed that this installation, when completed, will be one of the largest in the country. For the first time the number of the Company's consumers has crossed the 30,000 mark, the addition to the total during the past year having been 254. The dividend of 5% for the year on the consolidated ordinary stock leaves a balance of net revenue to be carried forward of £9,635. The balance at debit of Capital Account is £29,164. Two Directors who have resigned are replaced by Mr. Richard B. H. Ottley, Chairman of the United Kingdom Gas Corporation, Ltd., and Major Geoffrey H. Kitson, Chairman of the Leeds Corporation Gas Committee.

Trade Notes

Internal Transport.

Wilmot Trucks and Products, Ltd., Ivanhoe Truck Works, Scotts Green, Dudley, have recently issued a comprehensive catalogue of their numerous types of trucks and components for internal transport.

Rods and Hexagon Couplings.

An instance of the intensive specialization of Messrs. Head, Wrightson, & Co., Ltd., Thornaby-on-Tees, are their rods and hexagon couplings, which, the firm state, are accepted as standard for buildings, bridges, jetties, railways, and all types of public works. The material used in their manufacture is mild steel, fulfilling the requirements of the British Standard Specification, No. 15, for Structural Steel for Bridges, &c. The threads are Whitworth's standard, sharply and clearly cut. The stub ends may be plain or may be swelled so that the diameter at the bottom of the thread is not less than that of the rod.

"Rawlplug" and "Kango."

Here are two names synonymous with fixing problems. "Kango" electric hammers are claimed to be ideal for any work in connexion with building or allied trade which needs a percussive blow. The Rawlplug Company, Ltd., Rawlplug House, Cromwell Road, S.W. 7, enjoy the distribution rights of these useful tools, and their efficiency and soundness of construction aptly suits the firm's slogan "If it's a Rawlplug Product it's the best of its kind."

The "Kango" hammers can be used for such purposes as drilling up to 2 in. hacking, pointing, bush hammering, chase cutting any builder's material, tamping, vibrating and consolidating concrete mix for artificial stone, boiler and tank scaling, cutting or enlarging holes in floors, walls or ceilings, and, in fact, any work where a large number of percussion blows are required.

An Artistic Production.

The new catalogue of Ascot Gas Water Heaters, Ltd., is intended for gas engineers; the contents are semi-technical, embracing also practical aspects of installation. While appreciating to the full the value of the information contained in this publication, one cannot be otherwise than greatly impressed by the catalogue's artistic merit. There was a time when any attempt to render technical matter in an artistic form was severely regarded as nothing short of flippancy, since it was supposed to destroy the serious frame of mind in which the unfortunate reader was deemed correct to approach a serious subject. But now we know the merit of introducing a reasonable degree of attraction into lay-out and type, and find that far from distracting the attention of the reader, it actually stimulates the reader's ability to assimilate the knowledge contained in the text thus attractively presented. And, on reflection, one may be pardoned a deep sigh of relief at the change. A high standard is set by the cover of the publication and through pages, which, in greater or less degree, lend themselves to artistic treatment, that high standard is maintained.

Roughly four pages are devoted to each type of "Ascot" water heater. A short introduction to each type briefly indicates to what purposes it is suited; for example, the instantaneous boiling water model Type RS 52/1 is introduced as being "suitable for supplying unlimited boiling water for tea, coffee, and all hot drinks, cooking and general household or hygienic purposes. Water at any other temperature is also obtained." Then follows a specification giving the output, a useful table of gas rate inputs for varying calorific values, finish, constructional details, dimensions, and whether or not a flue is required. Particularly useful, too, are installation details which include data relating to gas and water regulation, head of water required, and meter capacity. Exterior and sectional views, together with views of typical installations, are given for each of the seven types described.

Dr. Bernard Friedman and the Directors of Ascot Gas Water Heaters, Ltd., should be very proud of this exceptionally fine publication, not the least useful feature of which is the novel, yet delightfully simple, manner in which the pages can be removed individually and others substituted as new information is available without upsetting the binding and continuity of the whole.

Regarding Benzole Recovery, Mr. A. F. Ames, Engineer and Manager of the Burnley Gas Department, reports that although a full twelve months' working of the newly installed plant has not yet been completed, he could safely say it would pay for itself in the first year. The production of benzole at Burnley in a year was comparable to obtaining a gas consumer taking 24 million cu.ft. of gas per annum at 2s. 6d. per 1,000 cu.ft.

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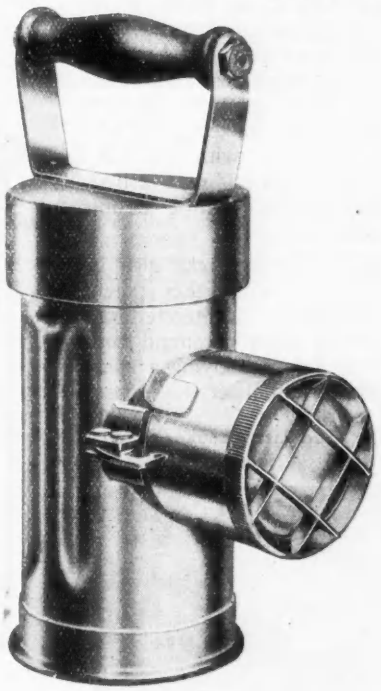

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Domestic Gas Ovens—

RELATION OF DESIGN TO COOKING QUALITY

by

E. W. B. DUNNING, B.Sc. (Lond.), A.I.C.,

and

R. F. HAYMAN, B.Sc. (Lond.), A.I.C.

(of the Watson House Cooker Laboratory, Gas Light and Coke Company).

A Paper read before a meeting of the London and Southern District Junior Gas Association held at the London School of Hygiene and Tropical Medicine, Keppel Street, W. 1—the PRESIDENT (Mr. R. N. LeFevre, of the Gas Light and Coke Company) presiding.

(*Concluded from p.* 658)

Radiation.

The effect of change of emissivity of the walls has been determined by using an oven which was blackened to give the maximum emissivity and then covered with aluminium foil to give a surface of low emissivity, then blackened again to examine the possibility of the insulating effect of the aluminium foil stuck on the enamel.

Scones were cooked in a normal oven and with various parts of the interior coated with aluminium foil. The most significant fact is that covering the base of the cooker with aluminium foil markedly increases bottom heat. Fig. 9, Curves 1 and 2, in which the base is left plain, have lower tray temperatures. Comparison of the tops of the scones indicates that lining the top of the oven with aluminium foil fails to give a corresponding increase in the top heat—

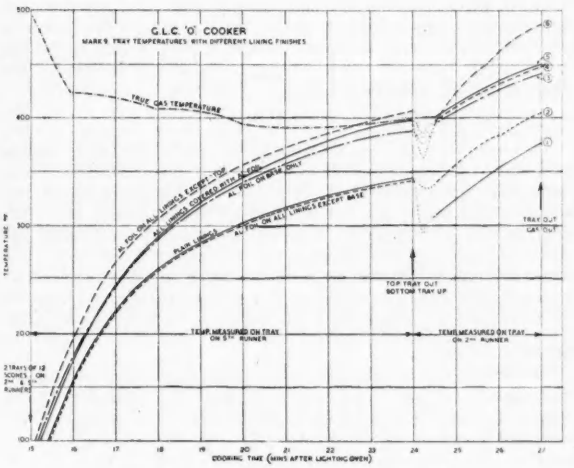
G.L.C. 'O' COOKER
MARK 9 TRAY TEMPERATURES WITH DIFFERENT LINING FINISHES
TRUE GAS TEMPERATURE
TRAY OUT
TOP TRAY OUT
BOTTOM TRAY UP
TEMP. MEASURED ON TRAY ON 5TH RUNNER
TEMP. MEASURED ON TRAY ON 2ND RUNNER
TEMPERATURE °F
COOKING TIME (MINS AFTER LIGHTING OVEN)

Fig. 9.

in fact, a reduction in top heat is obtained. The top of the oven, being hotter than the scone surface (see fig. 5), will radiate heat to it, and reduction in emissivity due to the aluminium foil will reduce this heat transfer. The undersides of the scones are heated by conduction through the tray, and this, being hotter than the base, will lose heat to the base by radiation. Reduction in emissivity of the oven base will reduce this radiation loss and thus lead to a higher tray temperature and increased bottom heat to the scones by conduction.

The food and its surrounding trays and tins will influence the heat transfer by radiation, and screening of direct radiation will take place which will reduce browning; on the other hand, heat will be radiated from the bottom of the top tray to the top surface of the cakes on a lower tray.

Theoretical Calculations of Heat Transfer by Convection and Radiation.

The foregoing tests illustrate some of the effects of changes in radiation and convection, but it is difficult to measure the relative amounts of heat transfer by these two methods. In view of the opinions expressed [42] that gas ovens heat by convected heat and solid fuel and electric ovens by radiant heat, calculations have been made of the heat transfer to a vertical cylinder, having a height equal to its diameter. This shape is a common one with foods—*e.g.*, round of beef, cakes, scones.

The surface temperature of the cylinder has been assumed to be 250° F. heated by hot gases at 450° F., first assuming natural convection and then that the speed of the hot gases is 2 ft. per second. Little experimental work has been carried out on short cylinders with exposed ends and further fundamental work with this shape would also be useful in the measurement of heat transfer to vessels on a hotplate.

The heat transfer by natural convection is given by the equation [46].

$$H = C \times 0{\cdot}3 \times T^{5/4} \text{ B Th.U. per sq.ft. per hour,}$$

where T is the temperature difference in degrees Fahrenheit and C is a factor depending on the size and shape of the body. If d is the diameter of the cylinder in feet then

$$H = C \times 0{\cdot}3 \times T^{5/4} \times 3/2\,\pi\, d^2 \text{ B.Th.U. per hour.}$$

The factor C has been calculated for 6 in., 3 in., and 1 in. diameter cylinders [46].

	C.
6 in.	= 1·3
3 ,,	= 1·35
1 ,,	= 1·6

These values are probably on the low side; from Griffiths and Davis' [47] measurements C = 1·5 for a 6 in. cylinder with insulated ends.

For forced convection the equation [48]

$$H = 0{\cdot}7\,\frac{V^{0{\cdot}56}}{d^{0{\cdot}44}} \times T \times 3/2\,\pi\, d^2 \text{ B.Th.U. per hour}$$

is used. V is the velocity in feet per second, T is the temperature difference in degrees Fahrenheit, and d the diameter of the cylinder in feet. This equation agrees fairly well with that derived by Bedford and Warner [12] for the loss of heat from a 6 in. copper sphere at velocities between 0·2-9·6 ft. per second.

The heat gained by radiation by a sphere of emissivity E_1 and radius r_1 and enclosed by another sphere of emissivity E_2 and radius r_2 is given by equation [49].

$$H = 17{\cdot}3 \times 10^{-10} \times \frac{E_1\,E_2}{E_2 + E_1\,(1 - E_2)\,\frac{r_1^2}{r_2^2}}\,(T_2^4 - T_1^4) \text{ B.Th.U. per sq.ft. per hour,}$$

where T_1 and T_2 are the temperatures in degrees Fahrenheit absolute of the surfaces of the inner and outer spheres.

Thus for a body of infinitely small size the emissivity of the walls has no effect on the radiation received, this being dependent solely on the emissivity of the body, the walls acting as perfect radiators. As the size increases the effect of a reduction in the emissivity of the walls becomes more marked.

We have assumed that the cylinder of food has an emissivity of 0·7 and the walls 0·9 when vitreous enamelled and 0·05 when covered by polished aluminium foil, and that the same formula may be used for a cylinder enclosed in a rectangular oven where r_1 is the radius of the cylinder and r_2 half the width of the oven—*i.e.*, 9 in. Calculations of possible radiation from the flue gases indicate that this is small, less than 10% of the total radiation; this factor has been ignored. Table 1 shows the theoretical heat transfer by convection and radiation under these various conditions, the percentage convection being given for still air; results for forced convection at 2 ft. per second are similar.

TABLE 1.—*Heat Transfer in B.Th.U. per Hr.*

Diameter of Cylinder.	Convection.		Radiation.				Percentage Convection.			
			$T_1 = 350$ (Internally Heated Oven)		$T_1 = 450$ (Externally Heated Oven)					
	Still Air.	Forced 2 Ft. per Sec.	$E_2 = 0{\cdot}9$.	$E_2 = 0{\cdot}05$.	$E_2 = 0{\cdot}9$.	$E_2 = 0{\cdot}05$.	1 and 3.	1 and 4.	1 and 5.	1 and 6.
	1.	2.	3.	4.	5.	6.				
6 in.	345	330	249	101	610	248	58	77	36	58
3 in.	90	112	63	46	154	112	59	66	37	44
1 in.	12	19	7	7	17	16	63	63	41	43

The above table suggests that in an internally heated oven rather more than half the heat transmission is by convection, in an externally heated oven the convection is about one third, and if the walls are polished metal the convection is about two-thirds of the total heat transfer.

VII. Cooking Quality and Temperature.

The large majority of gas ovens now in use are equipped with thermostatic control. So sound are thermostats in general that the public have become used to cooking exactly to the cooking chart and cookery book, regarding any error with extreme disfavour. This accurate control has imposed limits on the maker, and we have determined how much tolerance could be allowed in a thermostat before cooking was affected; there is no point in reducing the limits of error below the minimum error necessary to show up on cooking, provided the limits agreed upon can be maintained.

Five foods were chosen to give a fairly complete cooking range. The recipes were worked out after suitable experiments had been made to determine the recipe most readily reproducible when prepared by different operators.

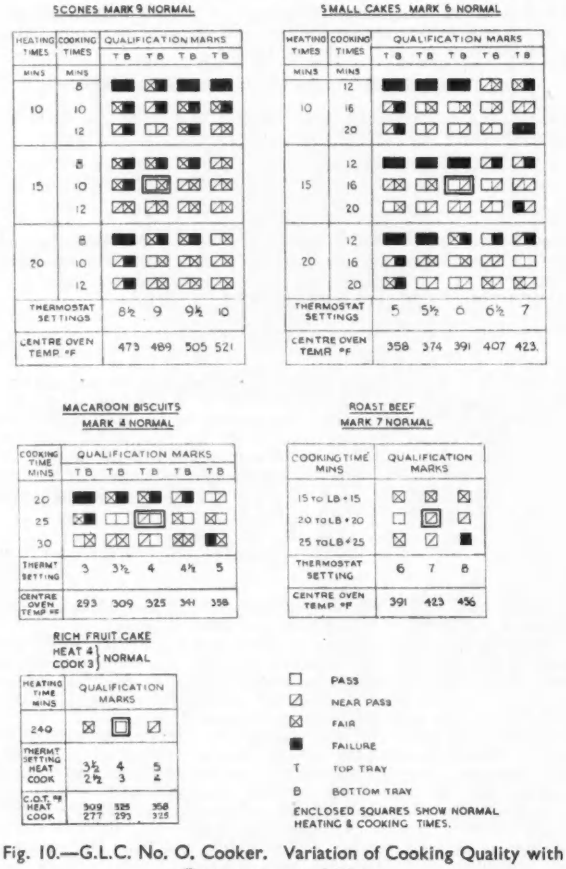
SCONES MARK 9 NORMAL
HEATING TIMES MINS
COOKING TIMES MINS
QUALIFICATION MARKS T8 T8 T8 T8
10 8 10 12
15 8 10 12
20 8 10 12
THERMOSTAT SETTINGS 8½ 9 9½ 10
CENTRE OVEN TEMP °F 473 489 505 521
SMALL CAKES MARK 6 NORMAL
HEATING TIMES MINS
COOKING TIMES MINS
QUALIFICATION MARKS T8 T8 T8 T8 T8
10 12 16 20
15 12 16 20
20 12 16 20
THERMOSTAT SETTINGS 5 5½ 6 6½ 7
CENTRE OVEN TEMP °F 358 374 391 407 423
MACAROON BISCUITS MARK 4 NORMAL
COOKING TIME MINS
QUALIFICATION MARKS T8 T8 T8 T8 T8
20 25 30
THERMT SETTING 3 3½ 4 4½ 5
CENTRE OVEN TEMP °F 293 309 325 341 358
ROAST BEEF MARK 7 NORMAL
COOKING TIME MINS
QUALIFICATION MARKS
15 TO LB + 15
20 TO LB + 20
25 TO LB + 25
THERMOSTAT SETTING 6 7 8
CENTRE OVEN TEMP °F 391 423 456
RICH FRUIT CAKE
HEAT 4 COOK 3 NORMAL
HEATING TIME MINS
QUALIFICATION MARKS
240
THERMT SETTING HEAT 3½ 4 5
COOK 2½ 3 4
C.O.T. °F HEAT 309 325 358
COOK 277 293 325
PASS
NEAR PASS
FAIR
FAILURE
T TOP TRAY
B BOTTOM TRAY
ENCLOSED SQUARES SHOW NORMAL HEATING & COOKING TIMES.

Fig. 10.—G.L.C. No. O. Cooker. Variation of Cooking Quality with Temperature and Time.

Fig. 10 shows graphically the results obtained. It should be noted that owing to test difficulties the bottom tray of scones and cakes was not moved up to the top shelf when the top tray was removed, and the results with the bottom tray are less satisfactory than normal.

The following conclusions may be drawn:

(1) The heating time is unimportant when the time of cooking is relatively long. Decreasing the heating time for short period cooking may give inferior results. A corresponding increase does not give such inferior results.

(2) A decrease in cooking time may give markedly inferior results: a corresponding increase gives less inferior results.

(3) For all cakes cooking at a temperature less than normal produces results inferior to cooking at an equivalent temperature above normal. Examination of fig. 10 will show this.

(4) From the limited data shown in fig. 10 and from experience of other tests the reverse of (3) is true for meat.

(5) 16° F. is the minimum temperature variation that produces differences in cooking quality detectable by experienced observers.

(6) 32° F. is the minimum temperature variation that produces differences in cooking quality detectable by the average housewife.

Thus in order to allow the maximum tolerance in thermostat calibration the thermostat setting should not be selected to give the best possible cooking result, but to give the midpoint of the variation which is acceptable to the average housewife—*i.e.*, ± 16° F.

VIII. Thermostatic Control.

The expansion of the thermostat rod controls the valve opening which adjusts the heat output; this controls the oven temperature, which in turn reacts on the thermostat rod. A theoretical treatment of many of the factors which affect the relationship between oven temperature and dial setting has been given by Benton ([50]).

Emissivity of Rod.

The temperature of a thermostat rod is higher when highly polished as compared with blackened, as the radiation loss to the cooler sides and roof is reduced. An increase in rod temperature must cause a decreased maintenance gas rate, and so the centre oven temperature is lowered with the polished rod. Dull brass has an emissivity of 0·22 ([48]), while carbonized grease may have an emissivity of 0·95, thus it is possible that the centre oven temperature may increase by about 10° F. when the oven has been in use a short time.

Bending of Rod.

The effect on the centre oven temperature of bending the thermostat rod has been examined, and it is found that this causes too low a temperature in the oven; if, however, the thermostat is then adjusted to give the correct centre oven temperature, bending can be continued until there is a considerable distortion (end of the rod displaced by 2 in.) before further errors are introduced. No difference results from straightening the rod and bending again to the same curvature, or if it is straightened it only requires readjustment to function normally.

Backlash.

Mechanical play between the dial and valve will cause a difference in temperature dependent on whether the head is rotated clockwise or anti-clockwise.

Gas Pressure.

A 100% increase in pressure increases the oven temperature by about 10° F.

Density and Calorific Value.

Increase in calorific value generally results in a decrease in density; both will increase the oven temperature.

By-pass Rate.

In any one oven the temperature is controlled by the heat input; the temperature of the oven cannot be less than that obtained with the by-pass gas rate, which controls the lowest temperature obtainable. Thus with too high a by-pass rate the lower dial settings may be inoperative.

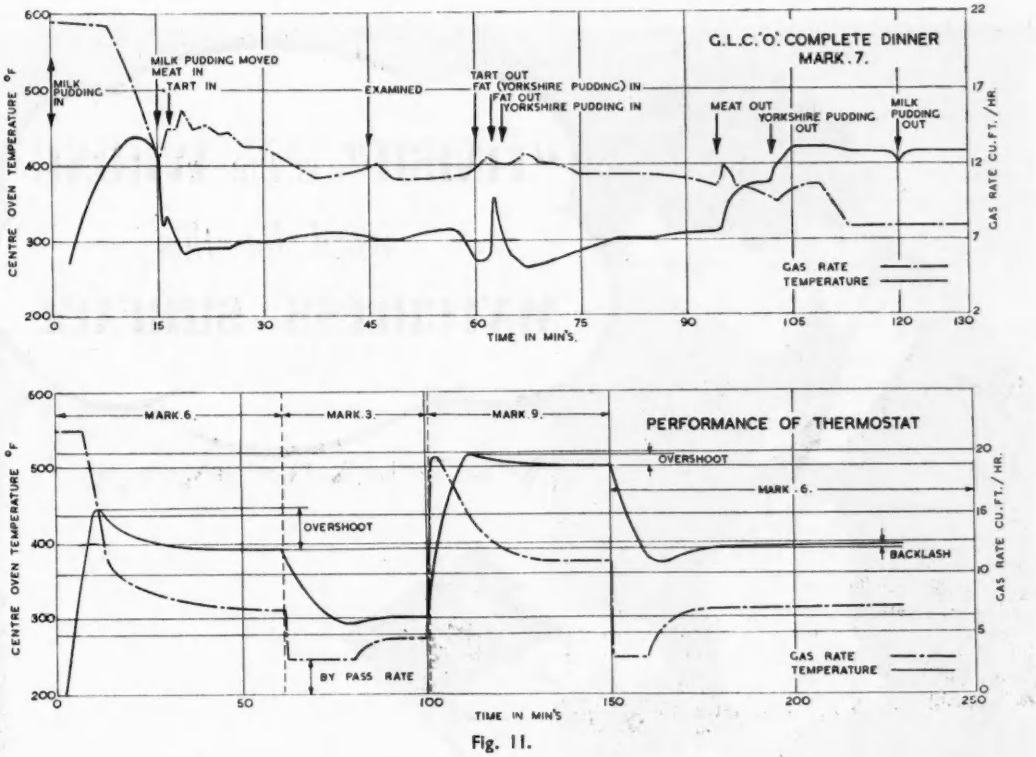

Fig. 11.

Maximum Gas Rate.

Similarly the maximum temperature obtainable is controlled by the maximum gas rate. Thus with too small a maximum gas rate the higher dial settings may be inoperative.

Heat Losses.

Increase in lagging efficiency or reduction in flue losses must reduce the gas rate necessary to maintain a definite oven temperature, and thus will lead to a higher temperature for the same dial setting.

Position of Thermostat.

The path of the flow of gases will determine the relation between oven temperature and rod temperature, and alteration in spatial position of rod or flue arrangement so as to vary the velocity of gases passing over the rod will affect the oven temperature.

Fig. 11 shows the variation of gas rate and oven temperature during the operation of a thermostat in an empty oven and during the cooking of a dinner.

It has already been suggested ([45]) to electric cooker manufacturers that uniformity of thermostat dial setting for cooking the same food would be advantageous and remove the need for special cookery books and the difficulty of giving new recipes in daily papers, journals, &c. There are wide differences in the dial setting and corresponding oven temperatures given by gas cooker manufacturers for cooking the same food. These differences may be due to:

(1) Wide range possible in obtaining the same cooking quality.
(2) Possible errors, as it is impossible to test every recipe in every oven.
(3) Variation of radiation and convection components of heat transfer.

It is probable that differences under (3) will be consistent for all foods in one type of oven, and only an alteration to the calibration would be necessary. This is borne out by the fact that makers often use the same thermostat in different types of oven, with perhaps different cookery charts.

IX. Thermal Insulation.

Lagging lessens the heat transmission through the sides of the oven and thus reduces the gas rate necessary to maintain a given temperature, hence the temperature of the kitchen, the size of flue outlet, and the heat lost through the flue are reduced. The insulation also reduces the temperature of the exterior surface of the cooker, but the surfaces which reach the highest temperatures, such as the door frame, obtain little benefit from the lagging.

The main property of the insulation material is its thermal conductivity, but the thermal capacity is also of importance. When a cold mass of food is placed in a hot oven the temperature falls and a high thermal capacity reduces the drop in temperature and improves the cooking quality, as the thermostat does not open fully and give a sudden rush of hot gases over the food.

Aluminium foil has a very low thermal capacity, but by increasing the thermal capacity of the interior oven linings by making them of cast iron, a greater speed of heating up should be obtained, as the thermal capacity is concentrated at the inner surface instead of being distributed through the lagging as with slag wool.

The heat transmission through the oven walls is partly determined by the surface conductance of the inner and outer linings, and doubling the thickness of insulation only reduces the heat loss by about one-fifth ([51]). Greater reductions in heat losses are obtained by reducing metallic conduction losses through supports for the inner linings ([52]); surface temperatures also are thereby lowered.

There is less tendency for slag wool to settle as the density of packing is increased. The settling occurs partly during transport and partly by vibration when fixed due to shutting the oven door. Thus an air space is left at the top of the lagging, and as this is the hottest part of the oven the heat loss may be considerable. The insertion of wire netting in the slag wool reduces the possibility of settling, which does not occur with insulation material made into a block. The latter type is generally more expensive and has a higher thermal conductivity.

Maintenance and cooking tests have been carried out in an oven packed with different densities of slag wool (0-24 lb. per cu.ft.). There was found to be little variation in cooking quality even with the air space lagging. The maintenance gas rate was 20% less with 8 lb. per cu.ft. density, and 34% less with 24 lb. cu.ft. density, compared with air space

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lagging, but the consumption of gas during cooking was only 14% and 21% less respectively.

X. Efficiency of the Cooking Process.

We have determined the gas consumptions required to cook a number of foods cooked at widely different temperatures. The tests were repeated, inserting empty cooking utensils into the oven at the correct times and opening the door for the same periods as in the previous tests. Finally the gas consumptions to heat the oven without utensils or opening the oven door were obtained. Fig. 12 shows the proportions of heat used to cook the food, heat utensils, &c. The amount required to cook the food varied from under 3% for puff pastry to over 20% for a complete dinner. Broadly, the greater the quantity of food that is cooked at one loading, the higher will be the thermal efficiency.

An attempt has been made to calculate the theoretical quantity of heat needed to heat up the food and evaporate water during the cooking process (see Table 2).

TABLE 2.

Food.	Wt. of Material, Oz.	Calculated Specific Heat.	Theoretical Requirement to Raise Food to Cooking Temp., B.Th.U.	Wt. of Water Evaporated in Cooking, %	Theoretical Requirement to Evaporate Water, B.Th.U.	Total Theoretical Requirement to Cook Food, B.Th.U.	Measured Requirement to Cook Food, B.Th.U.
A	B	C	D	E	F	G	H
Complete dinner–							
Meat	64	0·8	385	25·6	940	1,325	—
Potatoes ..	16	0·92	138	28·8	290	410	—
Yorkshire pudding ..	20	0·75	131	21·5	265	398	—
Apple pie ..	37	0·66	214	4·5	105	319	—
Rice pudding..	20	0·86	161	10·4	130	291	—
Totals ..	157	0·78	1,029	—	1,730	**2,743**	**2,475**
Madeira cake ..	26	0·40	116	7·0	110	**226**	**275**
Queen cakes ..	24	0·48	101	9·0	130	**231**	**185**
Puff pastry ..	17	0·47	70	13·9	125	**195**	**115**

Foodstuff.	Specific Heat Over Temp. Range Used in Cooking.	Reference.
Flour	0·50	(33)
Butter	0·50	(33)
Sugar	0·27	(34)
Starch	0·30	(34)
Milk	0·90	(35)
Egg	0·76	(36)
Potato	0·92	(36)
Beef	0·80	(37)
Water	1·0	

The agreement between the theoretical and measured heat requirement is fairly good, and it will be seen that between 50% and 60% of the total heat required for cooking the foods examined is expended in evaporating water.

XI. Conclusions.

(1) When tests are carried out under identical conditions there is no appreciable difference in the losses of vitamins, salts, water, &c., between gas ovens and ovens operated by other fuels.

(2) Combustion products are not absorbed by food, and even if they were absorbed would have a negligible effect.

(3) Staining of the oven and kitchen walls is due to cooking method rather than to oven design.

(4) Results of physical measurements in empty ovens give the same order of merit as heat requirements during cooking, but magnify the practical differences.

(5) It is impossible at the present time to forecast accurately the cooking quality by physical tests. Further research is needed, especially on the effect of velocity of hot gases.

(6) Little difference was found in cooking quality and heat requirements for a number of flue systems at present in use when other variations were eliminated, although the single top flue outlet was considerably less efficient.

(7) A reduced emissivity of the base led to a striking increase in bottom browning.

(8) Leakage of hot gases through poor door fit is unlikely to affect cooking quality, if the door gap is less than 0·02 in.

(9) Draughts may seriously affect cooking quality, and ovens should be designed to withstand a velocity of 5 miles per hour.

(10) A range of 30° F. in oven temperature is possible without the average housewife detecting any difference in cooking quality.

(11) Experienced observers can detect half this.

(12) Lagging has little effect on cooking quality, but leads to a reduction of up to 20% in gas consumption.

(13) More attention should be paid to reduction of heat loss by metallic conduction; this would improve efficiency to a greater extent than increase in insulation thickness, and would reduce external surface temperatures.

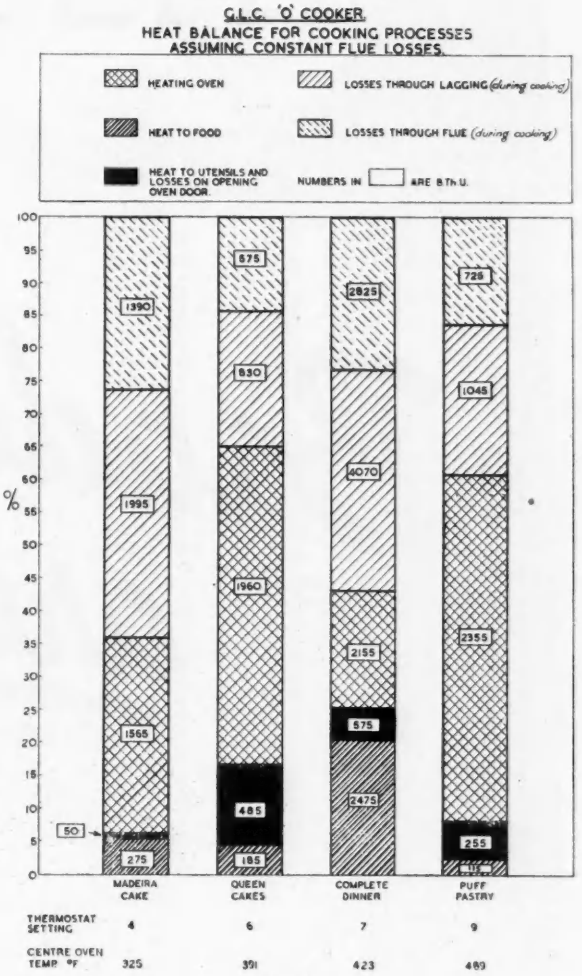


Fig. 12.

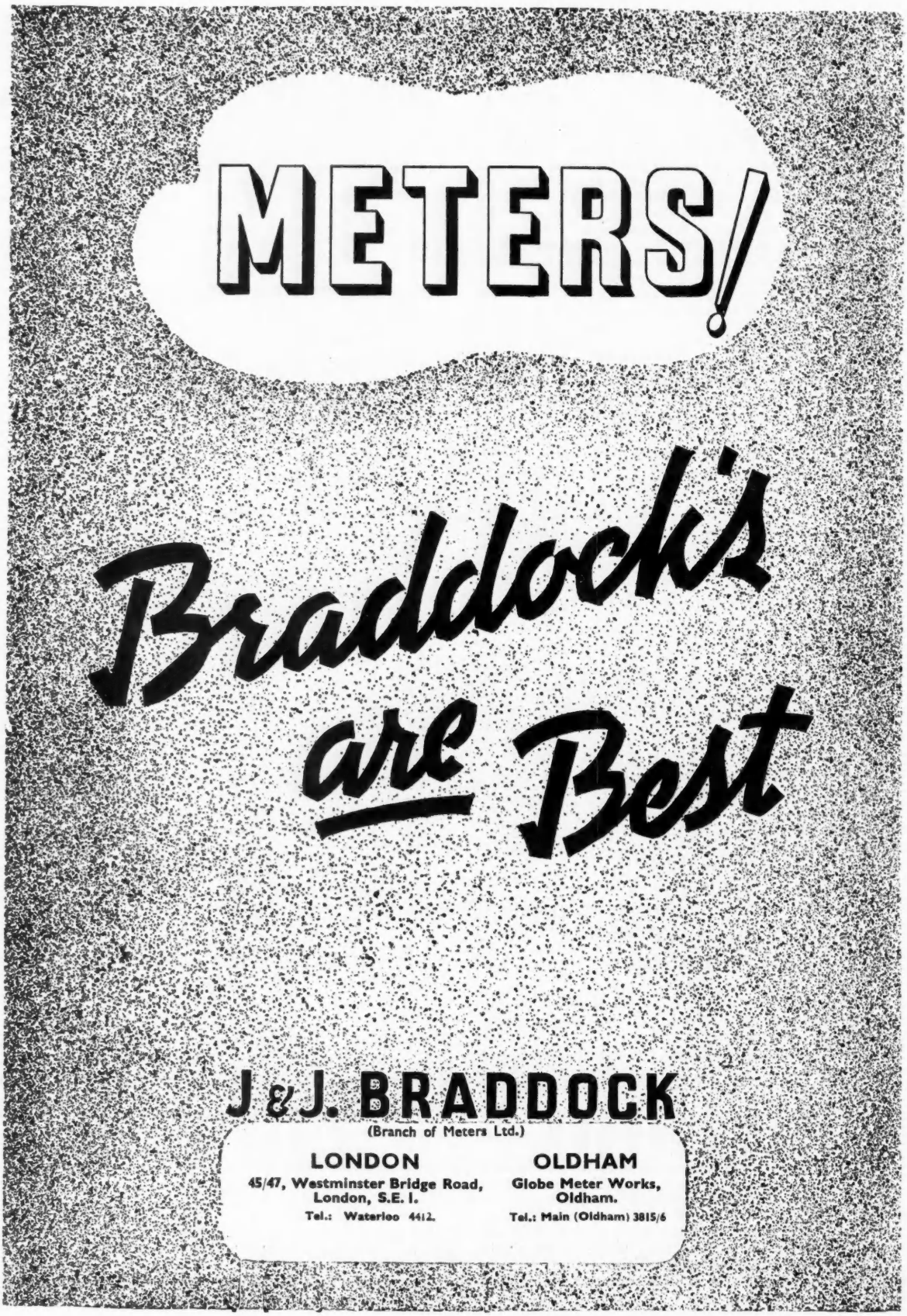
(14) Increased speed of heating up should be possible using insulators with low thermal capacity and concentrating the required thermal capacity in the linings, shelves, &c.

(15) The proportion of heat actually heating the food varied from under 3% to over 20%, the higher efficiency being obtained when the oven was fully loaded.

Defects.

Most complaints arising from gas ovens are due to the fact that some kind of food is incorrectly cooked, and this has to be transcribed into instructions to the fitter to remedy the complaint.

Few cooking complaints are due to defects in design or manufacture, some are due to incorrect adjustment which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the use of governors and fixed injectors would avoid, and the vast majority are due to errors on the part of the cook.

XII. BIBLIOGRAPHY.

Introduction.

[1] Hartley, F. W. "On Cooking by Gas." "JOURNAL OF GAS LIGHTING," **21**. 1872 ; p. 567.
[2] Sugg, W. "On Cooking with the Aid of Gas and the Ventilation of Kitchens." "JOURNAL OF GAS LIGHTING," **69**, 1897 ; p. 1,411.
[3] Fishenden, M. "House Heating," 1925 ; p. 192. Witherby.
[4] Report of the Gas Investigation Committee—"Standard Methods of Testing Gas Ovens." Trans. I.G.E., **73**, 1923-24 ; pp. 184-235.
[5] Forshaw, A. "Perfecting Modern Gas Ovens." Joint Proc. Jun. Gas Assocs., **19**, 1928-29 ; pp. 275-293.
[6] Angus, H. J. "Hotplate Efficiencies and Oven Ventilation." "GAS JOURNAL," **190**, 1930 ; pp. 41-43.
[7] Heathcote, W. "Cooker Research." Joint Proc. Jun. Gas Assocs., **11**, 1920-21 ; pp. 129-142.
[8] Benton, W. E. "Heat Losses from Gas Ovens." Joint Proc. Jun. Gas Assocs., **22**, 1931-32 ; pp. 69-81.
[9] Hartley, H. "Developments in Gas Cookers." Joint Proc. Jun. Gas Assocs., **13**, 1922-23 ; pp. 269-289.

The Cooking Process ; Cooking Quality ; Losses During Cooking.

[10] Lowe, B. "Experimental Cookery," 1932. Chapman and Hall.
[11] Fisher, E. A. "Flour Quality—Its Nature and Control." The Nat. Joint Ind. Council for the Flour Milling Industry. Pam. No. 3, January, 1935.
[12] "The Application of Heat to Bread Baking." Amer. Gas Assoc. Res., June, 1930.
[13] Peet, L., and Lowe, B. "Report on Oven Cookery Study." Project No. 490. Iowa State College, U.S.A.
[14] Private Communication from Radiation Research Laboratories.
[15] King, F. B. "Obtaining a Panel for Judging Flavour in Foods." Food Res., **2**, 1937 ; pp. 207-219.
[16] Maiden, A. M. "A System of Judging Flavour in Bread." Chem. and Ind., **14**, 1936 ; pp. 143-145.
[17] Moir, H. C. "Some Observations on the Appreciation of Flavour in Foodstuffs." *Ibid.*, pp. 145-148.
[18] Kon and Watson. "Effect of Light on Vitamin C of Milk." Biochem. J., **30**, 1936 ; pp. 2,273-2,290.
[19] Englehart and Bukin. Biochimia, **2**, 1937 ; pp. 587-601.
[20] Christensen, Latzke, and Hopper. "Influence of Cooking and Canning on Vitamin B1 and B2 Content of Lean Beef and Pork." J. Agric. Res., **53**, 1936 ; pp. 415-432.
[21] Scheunert, A., and Schieblich, M. "Vitamin Content of Wheat and Rye and of the Meal and Bread prepared from Them." Biochem. Z., **290**, 1937, pp. 398-418.
[22] McCance, R. A., and Shipp, H. L. "The Chemistry of Flesh Foods and Their Losses on Cooking." Med. Res. Council, 1933, H.M.S.O.
[23] Cottington-Taylor, D. D. "Comparison of Gas and Electricity for Domestic Cooking." Good Housekeeping Inst., July, 1933.
[24] Alexander, L. "New Methods of Meat Cookery." A.G.A. Proc., 1932, pp. 565-570.
[25] Shank, D. E. "Gas, the Ideal Cooking Fuel." Amer Gas J., **142**, 1935, p. 29.
[26] University of Missouri Bulletin No. 293. Western Gas, **10**, 1934, p. 44.
[27] Arnaud, F. W. F. Rep. of County Analyst (Kent). Analyst, **59**, 1934, p. 405.
[28] Noble, T. G., Halliday, E. J., and Klass, H. K. "Studies on Tenderness and Juiciness of Cooked Meats." A.G.A. Proc., 1934, pp. 643-646.
[29] Robinson, P. J., and Hoadley, E. E. "Electric Cooking, Domestic and Commercial." I.M.E.A. Annual Convention, Bournemouth, 1933.
[30] Conner, R. M. "Baking Characteristics of Gas and Electric Ranges." A.G.A. Monthly, 1935 ; pp. 102-104.
[31] Merriam, G. W. "Domestic Gas Ranges." Pub. Amer. Gas J., 1937.
[32] American Dietetic Association Reports, No. 34, 1933.
[33] Sciver, A. "Losses in Meat on Cooking." Analyst, **59**, 1934 ; pp. 536-537.
[34] Sherman, H. C. Chemistry of Food and Nutrition, 1937. MacMillan.

Effect of Products of Combustion.

[35] Masterman, C. A., and Dunning, E. W. B. "Report on the Combustion Standards of Gas Appliances." Trans. I.G.E., **81**, 1931-32, pp. 142-189.
[36] Masterman, C. A., Dunning, E. W. B., and Densham, A. B. "Report on Air Vitiation and Gas Appliances." Trans. I.G.E., **85**, 1935-36, pp. 95-166.
[37] "Domestic Heating by Gas Considered from the Point of View of Health and Comfort." Royal College of Physicians of London. Harrison and Sons, 1936.
[38] Watson House. Unpublished work.
[39] "Investigation of Domestic Cooking by Gas and Electricity." Bull. No. 6. A.G.A., April, 1935. See also 9.

Heat Transfer to Food During Cooking.

[40] Barker, A. H. "Tests on Ranges and Cooking Appliances." Building Mat Res. Comm. Fuel Res. Board Report, No. 4, 1922, H.M.S.O.
[41] Chamberlain, E. A. C. "A Suction Pyrometer for the Determination of Gas Temperatures up to 2,000° F." Chem. and Ind., **56**, 1937 ; pp. 395-396T.
[42] Bedford, T., and Warner, C. G. "The Globe Thermometer in Studies of Heating and Ventilation." J. of Hygiene, **34**, 1934 ; p. 458.
[43] Masterman, C. A., and Noble, T. G. "Gas Fire Flues and Ventilation." Trans. I.G.E., **81**, 1931-32 ; p. 646.
[44] Chandler, D. "Non-aerated Flames in Gas Ovens." "GAS JOURNAL," **220** 1937 ; pp. 345-351.
[45] Humphreys, O. W. "The Design of Domestic Electric Cookers." Inst. Elect. Eng., Jan. 20, 1938.
[46] Fishenden, M., and Saunders, O. A. "Technical Data on Fuel," 1935 ; p. 182. Spiers.
[47] Griffiths, E., and Davis, A. H. "The Transmission of Heat by Radiation and Convection." D.S.I.R. Food Investigation Spec. Rep., No. 9. 1931. H.M.S.O.
[48] Schack, A. "Industrial Heat Transfer," 1933 ; p. 127. Wiley.
[49] Fishenden, M., and Saunders, O. A. "The Calculation of Heat Transmission," 1932. H.M.S.O. See also 5, 6, 12.

Thermostatic Control ; Thermal Insulation ; Cooking Efficiency.

[50] Benton, W. E. "Thermostatic Control of Gas Ovens." Joint Proc. Jun. Gas Assocs., **21**, 1930-31 ; pp. 85-97.
[51] Domestic Gas Range Research. A.G.A. Bull. No. 7, December, 1936.
[52] Van Dusen, M. S. "Heat Transfer through Metal Enclosed Insulation." Bur. of Standards J. of Res., **5**, R.P. 207, 1930 ; pp. 385-397.
[53] Spillers Limited.
[54] Hodgman, M. S. Handbook of Chemistry and Physics, 1936-37. Chem. Rubber Pub. Co.
[55] Milk Marketing Board.
[56] Low. Temp. Res. Station, D.S.I.R.
[57] Awbery, J. H., and Griffiths, E. "Thermal Properties of Meat." Chem. and Ind., **52**, 1933 ; p. 326. See also 45, 48.

(The discussion which followed will be published in a subsequent issue.)

Temperature Measurement

by W. BOWEN, Member of the Faraday Society

The Paper recently read by Mr. E. Haden, of the Birmingham Gas Department, and reported in "GAS JOURNAL" of Dec. 8, 1937, represents the point of view of an able and experienced technical user of pyrometers, and such a viewpoint is always welcomed warmly by pyrometer makers in that it brings out features of merit through proved usage and features of weakness (if any) which require improvement. However, while recognizing Mr. Haden's advice on sources of possible trouble and error in various equipments, he has unfortunately not "balanced" his statements by a "contra-account" of the merits of pyrometers; and in some cases his warnings are tantamount to an unfair condemnation. In the following remarks, I seek to present the "contra-account."

The Author, an instrument maker of long experience, contributes the following notes based upon Mr. E. Haden's recent Midland Junior Paper (see "JOURNAL," Dec. 8, 1937).

The Resistance Pyrometer.

Since change of resistance is the essential principle, it is obvious that whatever causes such resistance change will affect the reading of temperature. But Mr. Haden's example of an accidental stretching of the connecting cable (causing increased resistance) must be of the rarest occurrence and hardly justifies (in itself) his discarding of the type. In the first place, an accident can happen to any form of pyrometer; and, secondly, equal stretching of compensating cables would cause no error, while unequal stretching would only shift the "zero" and could have been corrected quickly by a readjustment of resistances in the circuit. The broken support should have been firmly refixed, and not the pyrometer condemned for such a fault.

I quite agree that bad contacts, broken strands of wire, &c., are insidious sources of trouble and error which must be avoided not only in the resistance type, but in all other types in about equal degree. The forces available for temperature measurement in electrical pyrometers are too small to permit resistance alterations in the circuit of any great amount, and careful checking of joints periodically will save a lot of worry in regard to accuracy. Moisture, of course, causes leakage electrically, and so must be avoided; but this is a matter of proper protection of the elements and other parts of the circuits, and is not peculiar to the resistance type alone. Neither is the further precaution mentioned by Mr. Haden—namely, the preservation of the elements from crystallization or contamination through excessive temperatures and contact with gaseous fumes. Thermocouples as well as resistance

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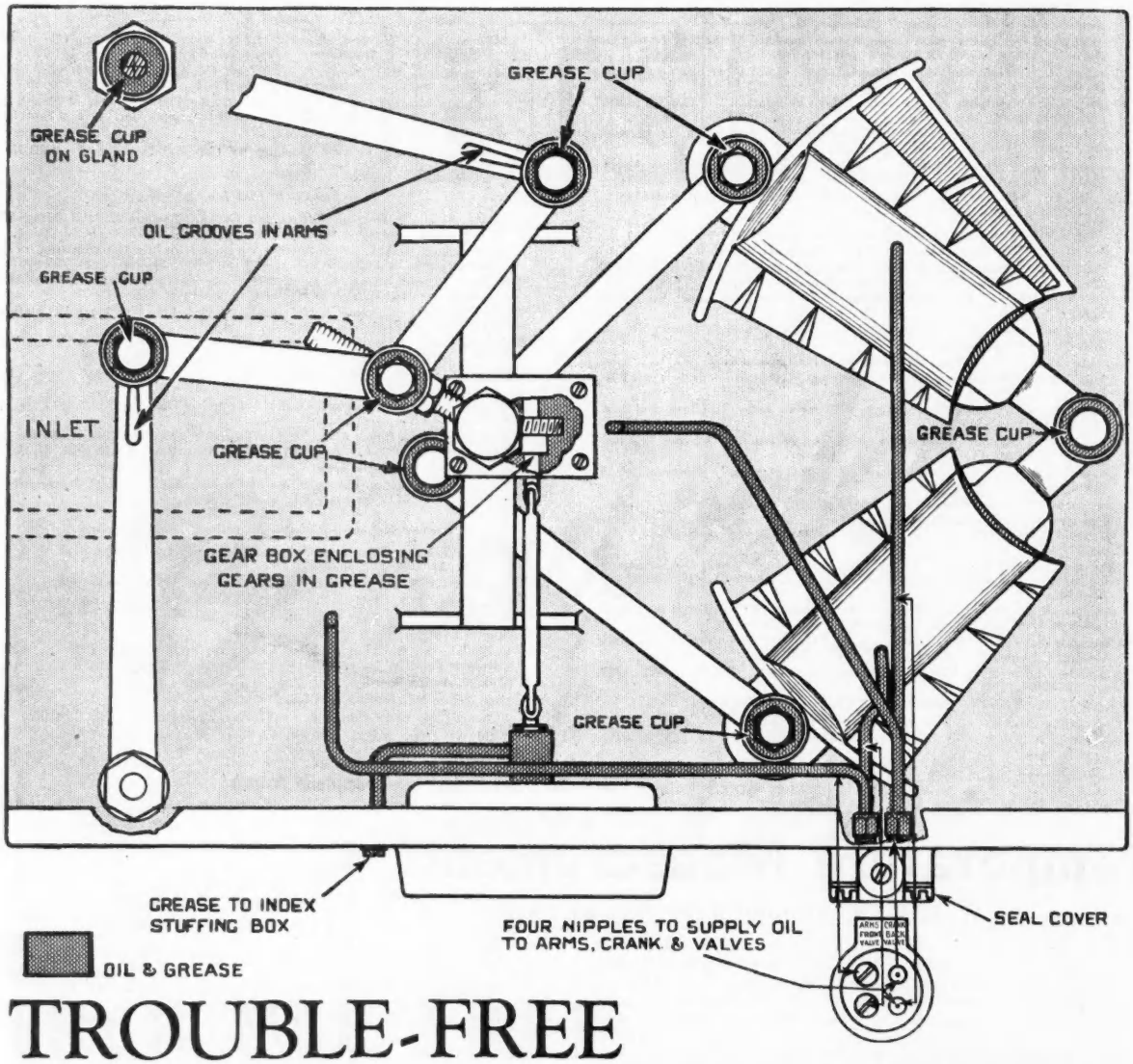

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elements must be effectively protected by proper sheaths of non-porous nature. It is common practice also to restrict nickel resistance elements to temperatures below 300° C. and platinum elements to below 550° C. for this reason.

Within these limits and with such protection the resistance pyrometer possesses an accuracy superior to all other types, normal pyrometers being correct to about 1/10° C. and special forms to 1/10,000° C. There is no "cold junction" effect to allow for, which means that the readings are always accurate provided the correct battery current is employed. In "null" readings, or in "ohmmeter" readings, even the latter would not cause error, and for all forms of resistance pyrometers it is possible to apply practically constant mains supply (*i.e.*, d.c. mains by potential divider, or a.c. mains by rectifier) to enable the resistance pyrometer always to read correctly without attention of any kind.

The Thermo-electric Pyrometer.

Mr. Haden is in error when he states that a "base-metal outfit is usually a low resistance circuit—the rare-metal outfit is a high resistance circuit with an indicator having a delicate suspension." This remark may have been true some 20 years ago, but it is certainly not true of modern pyrometers of best makes. The high-resistance circuit applies to both rare-metal and to base-metal thermocouples, the sensitivity of indicator or recorder being on the average about 10 to 15 ohms per millivolt, which means a circuit resistance of 100 to 200 ohms for the rare-metal thermocouple, or of 400 to 800 ohms in the case of the base-metal thermocouple. Thus whatever arguments lie in favour of high-resistance circuits apply in even greater degree with the latter thermocouple.

Regarding the form of support for the moving coil, pivoted indicators of the above sensitivity can be obtained, but the best forms of recorder employ suspended coils for the reason that the initial strains in the pivots will not stand the periodic extra stresses imposed by the "dotting" mechanism of the recorder. A simple suspension, as employed in some recorders, is free from rotational friction, but needs careful levelling, and will not permit of vibration (causing sway of the pointer) or shock (causing breakage of suspension). There is also present a "zero creep" needing readjustment of the pointer zero at intervals. I have adopted a special form of support in which the merits of pivots and suspensions are retained while eliminating the defects of both types. A short suspension is made resilient by a special process, so that it is unbreakable within the limits of operation, and so that its "zero creep" effect is practically *nil*, and the moving coil is supported by this suspension so that there is no "pivot friction" in its movement. A pair of pivots is used merely to maintain concentricity between coil and magnet at all reasonable angles from the horizontal and so the process of levelling is eliminated without any strains being imposed on the pivots themselves. Using this system, indicators of sensitivity 12 ohms per millivolt weigh only 6·5 lb. (as compared with 13 lb. in other forms of equal sensitivity), and sensitivities as high as 60 ohms per millivolt have been constructed without extra weight (largely magnet weight), and without levelling. Further to these remarkable results, recorders so fitted have been in daily operation for over 14 years, making "dot" records every 20 seconds, or a total of over 22 million "dots," without the slightest attention or repair.

Referring now to Mr. Haden's points under this heading in their order:

(1) Whilst agreeing entirely as to the elimination of bad contact, I would emphasize that in a 10 ohm (low resistance pyrometer) circuit a "bad" contact of 1 ohm resistance cannot be tolerated, as it means an error of 10%, whereas in a 200 ohm (high resistance pyrometer) circuit the same contact resistance means an error of only 0·5%.

(2) Similarly regarding alterations in lengths (and resistances) of thermocouples and/or connecting cables. One ohm resistance represents approximately 10 ft. of thermocouple or 10 ft. of compensating cable or 100 ft. of copper cable (taking rough figures). Such a variation of 1 ohm can be tolerated in a thermocouple pyrometer of high resistance type, but even 0·1 ohm would cause a serious error in a low-resistance circuit.

(3) I agree with Mr. Haden as to the advisability of using heavy switches in pyrometer circuits, and in these special materials should be employed to eliminate thermoelectric efforts, corrosion, bad contacts, &c. This is most important, if the user wishes to avoid continual trouble. The use of a common return lead in a multiple pyrometer is also to be avoided wherever possible, as the method invites insidious errors often hard to locate and cure.

(4) As to conduction loss and error due to insufficient depth of immersion of the thermocouple in the source of heat, tests have shown that a minimum length equal to six times the diameter of the thermocouple (or its protecting tube or sheath) should be immersed completely to avoid conduction loss.

(5) I also agree with Mr. Haden on his conclusions under this heading. For all "dial" type instruments accurate balancing of the moving system is absolutely essential for accuracy of reading; but the "dial" type is, of course, a low-resistance circuit, which for other reasons mentioned above should not be employed. A high resistance pyrometer employs a vertical coil axis and a horizontal pointer (the tip of which may be turned vertical as in the "edge-wise" indicator), and in these the "balance"—while being desirable in full accuracy—is not at all vital provided the instrument is level or approximately level.

(6) Mr. Haden's reference to recorders of inked thread form leaves out the recorders of the "inked ribbon" type. During my 27 years' experience in pyrometry I have always failed to understand why the inked thread form should ever have been tolerated; the threads easily break and need frequent renewal, and the records or "dots" extend sometimes over 20° and so are difficult to estimate with accuracy. On the other hand, a ribbon never breaks, needs renewal only once every three to six months, and the record "dots" are either circular and small, or they extend along the time scale and not along the temperature scale, so that the temperature is easily and accurately registered.

The Optical Pyrometer.

I regret to note Mr. Haden's prejudicial remarks in connexion with the first optical pyrometer which he has described, and although he winds up his remarks nicely, the total effect is that he seems to "damn it with faint praise." As I am in daily contact with troubles, with repairs and constructions, of pyrometers of all kinds, including the particular pyrometer under consideration, I believe no one is in a better position to judge of the frequency and importance of such trouble items as Mr. Haden relates, and I must state that I have never experienced myself—or heard complaints from others—on the question of a bad switch, or of rapid drop of battery current with the "Optix" pyrometer. Therefore I think that the instrument to which Mr. Haden refers either needs attention or it is used under peculiarly severe conditions. It is, of course, quite true that when starting from "cold," the initial battery voltage drops after a minute or two, but on the other hand, the settings left from previous tests should not be altered until the battery has "settled down," when those settings will in all likelihood still apply, or require little alteration or time involved. Further, an ammeter setting which is incorrect by 1 ma. (*i.e.*, 57 ma. against correct 56, say) will not cause an error of 10 degrees, and in cases where this matters, or where many repeat readings are required, I suggest that the user applies a larger dry battery (carried in his pocket) with a short twin lead through a hole in the bottom cover of the instrument, ending internally in a suitable block carrying spring terminals and of shape similar to the flash-lamp battery which it replaces. Even when so fitted, the "Optix" is handy and speedy. Running at low current values, the life of both battery and lamp are a maximum, the weight carried is a minimum, the eyestrain is also a minimum, the scale of the "Optix" is long, and the instrument is capable of measuring small hot spots at a considerable distance away. Further, the important feature of "self-checking" places the user in an independent position of reliance of temperature readings taken, without external apparatus.

The Phototube Pryometer.

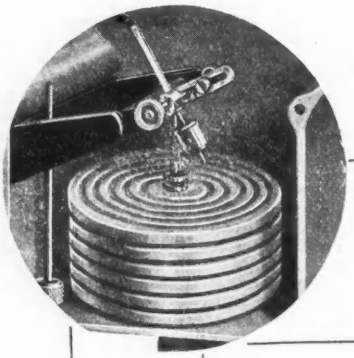
The introduction of the photocell has intrigued me for more than 20 years, and I have made many extensive experiments with different forms and types of such cells. To-day photocells are used in a variety of ways most successfully. However, as the sensitive element in a pyrometer, there are many difficulties which so far render the type unreliable.

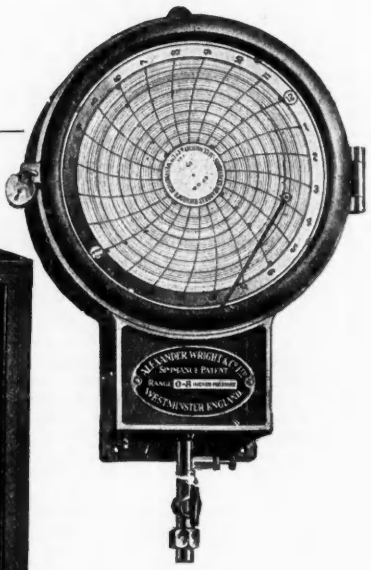
Finally, I wish to congratulate Mr. Haden on the latter part of his valuable Paper. His advice should greatly assist any pyrometer user.

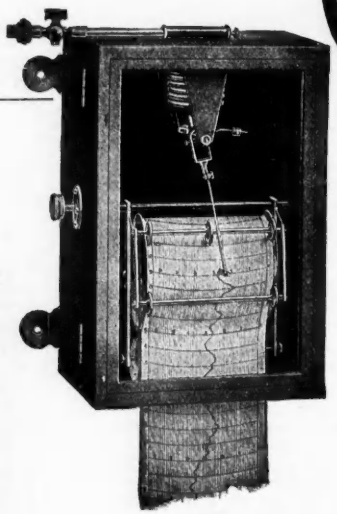
Athletic and Social

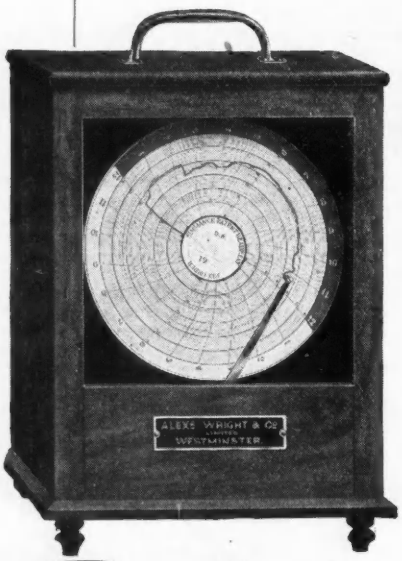
A Table Tennis Champion.

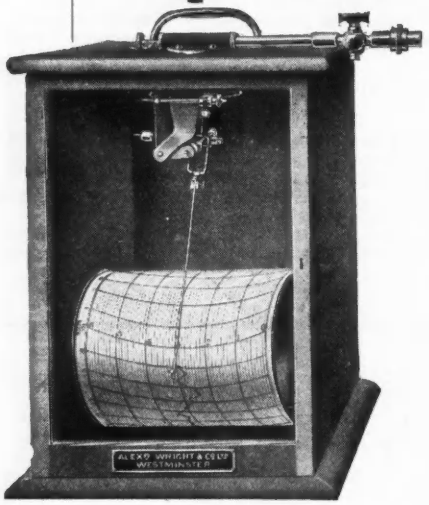
Mr. Arthur Sadler, son of Mr. J. Sadler, who for many years has represented the Parkinson Stove Company, Ltd., in South Wales, captained Wales in the International Table Tennis Match against Ireland at Rhyl on March 5. Mr. Sadler recently represented Wales in the World's Table Tennis Championship at the Albert Hall. He has also represented Birmingham on no fewer than 36 occasions in Inter-City matches, and is one of the earliest members of the side. In 1936 he won the Birmingham Closed Championship and has to his credit many Midland Tournaments during his time in that city. Mr. Sadler has represented Wales on four other occasions against England and Ireland.











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Markets and Manufactures

Current Sales of Gas Products

The London Market

March 7.

There are a few changes to record in the prices of Tar Products in the London market, which are as under:

Pitch, 36s. to 37s. per ton f.o.b.
Creosote, about 5¼d.
Refined tar, 3¾d.
Pure toluole, 2s. 2d. to 2s. 3d.
Pure benzole, 1s. 8d.
95/160 solvent naphtha, 1s. 7d.
90/160 pyridine, 10s. to 11s.
All per gallon naked at makers' works.

The Provinces

March 7.

Crude Gas-Works Tar, 22s. 9d. to 27s. 9d.

To avoid misunderstanding, it is necessary to state that the above price is not claimed to represent a market value. It is a price worked out from week to week upon a system which has been used for many years as a basis for the fixing of certain contracts for crude tar of varying qualities in different areas.

The average prices of gas-works products during the week were: Pitch—East Coast, 36s. 6d. to 37s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 36s. 6d. to 37s. 6d.* Toluole, naked, North, 1s. 7½d. to 1s. 9d. Coal tar, crude naphtha, in bulk, North, 8d. to 8½d. Solvent naphtha, naked, North, 1s. 4½d. to 1s. 5d. Heavy naphtha, North, 1s. 3d. to 1s. 3½d. Creosote, *ex* works, in bulk, North, liquid and salty, 5d. to 5½d.; low gravity, 4¾d. to 4½d. Heavy oils, in bulk, North, 5d. to 5¼d. Carbolic acid 60's, 3s. to 3s. 3d. Naphthalene, £13 10s. to £16. Salts, 80s. to 85s., bags included. Anthracene, "A" quality, 4½d. to 4¾d. per minimum 40% purely nominal; "B" quality unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Scotland

GLASGOW, *March 5.*

There is still a lack of orders of a substantial nature, but, on the whole, prices are fairly well maintained.

Crude gas-works tar.—Actual value is 37s. to 38s. per ton *ex* works in bulk.

Pitch remains very quiet at 28s. to 30s. per ton, f.o.b. for export, and round 28s. per ton *ex* works in bulk for home trade.

Refined tar.—Prices for the home market are fixed for the season at 3¾d. to 4d. per gallon *ex* works naked. For export, quotations are round 3d. to 3¼d. per gallon, f.o.r. in buyers' packages.

Creosote oil.—Distillers are in a comfortable position and quotations are well held as under: Specification oil, 5d. to 5¼d.; low gravity, 6¼d. to 6½d.; neutral oil, 5d. to 5¼d. per gallon, all *ex* works in bulk.

Cresylic acid.—There is practically no business of any consequence moving and quotations are easy as follows: Pale, 97/99%, 2s. 7d. to 2s. 9d. per gallon; dark, 97/99%, 2s. 5d. to 2s. 7d. per gallon; and pale, 99/100%, 2s. 9d. to 3s. 3d. per gallon; according to quality, all *ex* works in buyers' packages.

Crude naphtha. — Available supplies readily command 6d. to 6¼d. per gallon *ex* works in bulk, according to quality.

Solvent naphtha.—90/160 is changing hands at 1s. 5d. to 1s. 6d. per gallon, and 90/190 at 1s. 1d. to 1s. 2d. per gallon.

Motor benzole is said to be valued at 1s. 4½d. per gallon, but supplies are unobtainable locally.

Pyridine.—Business can now be arranged in limited quantities at 12s. to 12s. 6d. per gallon for 90/160 grade, and 13s. to 14s. per gallon for 90/140 grade.

Benzole Prices

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.	
Crude benzole..	0	9	to	0	9½	per gall. at works
Motor " ..	1	2½	"	1	3	" " "
90% " ..	1	3½	"	1	4	" " "
Pure " ..	1	7½	"	1	8	" " "

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Gas Fittings.
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Mantles.
Ellesmere Port Gas Department. [p. 754.]

Meters.
Ellesmere Port Gas Department. [p. 754.]
Stockton-on-Tees Gas Department. [p. 754.]
Workington Gas Department. [p. 754.]

Oils.
Workington Gas Department. [p. 754.]

Stores.
Stockton-on-Tees Gas Department. [p. 754.]
Workington Gas Department. [p. 754.]

Tubes, Pipes, and Specials.
Ellesmere Port Gas Department. [p. 754.]
Workington Gas Department. [p. 754.]

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H.M. Senior Trade Commissioner in South Africa reports that the Cape Town Electricity Supply Commission is calling for tenders (Specification No. 136/1938) for the supply and delivery to the Salt River Power Station, Siding 804, Cape Town, of quantities of straight flanged cast-iron pipes and special pipe castings, together with rubber insertion joints, bolts, nuts, and washers. Tenders, endorsed "Tender for Pipes and Specials, &c.," should be addressed to the Local Manager, Electricity Supply Commission, Cape Town Undertaking, Dock Road, Cape Town, South Africa, by whom they will be received up to noon on April 8, 1938. **(Ref. T. 18404/38.)**

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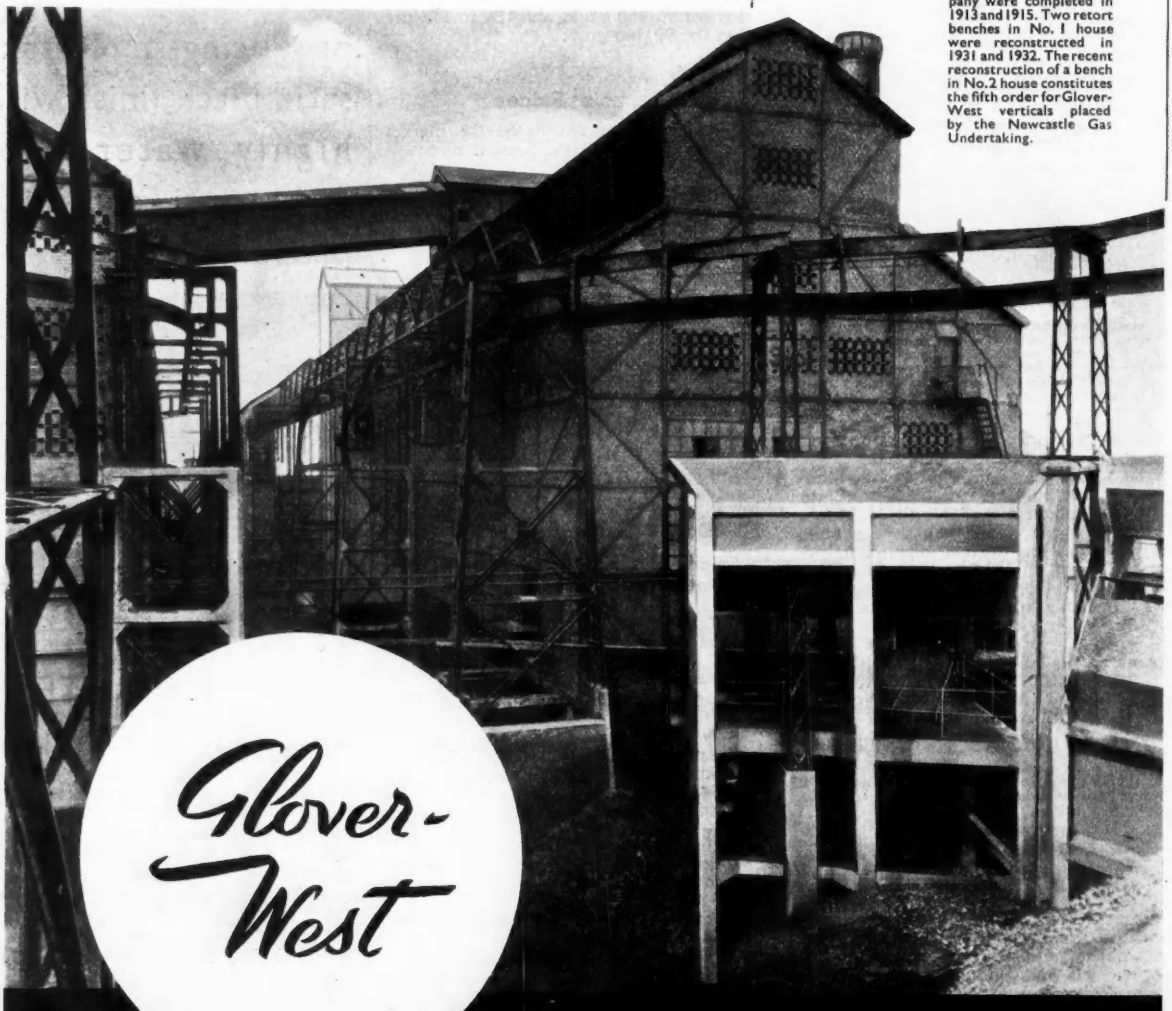

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GAS STOCKS AND SHARES

Taxation fears led to a sharp set-back in Stock Exchange conditions last week. Gilt-edged stocks met the full force of the reaction and in the absence of support much of their former improvement has been lost, so that many of these stocks now stand at very little above this year's lowest levels. The position was much the same in other sections, and although some of the marking down has been severe this is largely attributable to the fact that the ordinary investor has been marking time until the present readjustment period is over. Doubtless the usual Budget rumours will soon be spread, and despite the bargains now obtainable business will be somewhat erratic until the Chancellor's taxation proposals are known.

The Gas market recorded a fair number of transactions, and although there was not the substantial marking down of prices prevalent elsewhere this section did not escape entirely. It will be seen in the Official List that several leading ordinaries reacted, but, with the exception of Imperial Continental, which dropped a further 4 points to 118-123, the falls were of a minor nature. A purchase of Imperial Continental at the current low price both for yield and capital appreciation is worthy of serious consideration. On the provincial Exchanges the only movement occurred in Newcastle units which closed 3d. cheaper at 23s., while in the Supplementary List Ryde ordinary suffered a further sharp drop of 7½ points to the low price of 145.

Two important issues of stock were notified during the week—viz., £600,000 by the South Metropolitan Gas Company, and £400,000 by the Wandsworth and District Gas Company. Both issues consist of 3¾% redeemable debenture stock, 1963-68, and were sold to the Companies' brokers at 100½ net. Interest on the South Metropolitan stock is payable on Feb. 1 and Aug. 1, and that on the Wandsworth stock on Jan. 1 and July 1—the first payment dating from the time of settlement for the issues.

Official Quotations on the London Stock Exchange

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Mar. 4.	Rise or Fall on Week.
1,767,439	Sept. 6	8	8	Alliance & Dublin Ord. ...	157—162	...
374,000	Dec. 13	4	4	Do. 4 p.c. Deb. ...	95—100	...
558,190	Nov. 15	5	5	Asscd. Gas & Water U'd'ts Ord.	18/6—20/6	...
500,000	,,	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	19/—21/-	...
216,041	,,	—	§-/4	Do. 4 p.c. Red. Cum. Pref.	19/—20/-	...
278,590	,,	§-/2⅞	4	Do. 4 p.c. Irred. Cum. Pref.	17/—19/—	...
500,000	Sept. 6	§35/—	3½	Do. 3½ p.c. Red. Deb. ...	95—100	...
558,890	Feb. 21	7	7	Barnet Ord. 7 p.c.	158—163*	...
300,000	Oct. 4	1/9¾	1/4½	Bombay, Ltd.	26/—28/—	...
179,915	Feb. 21	9½	9½	Bournemouth sliding scale ...	197—202*	...
590,407	,,	7	7	Do. 7 p.c. max. ...	156—161*	...
493,960	,,	6	6	Do. 6 p.c. Pref. ...	131—136*	...
50,000	Dec. 13	3	3	Do. 3 p.c. Deb. ...	78—83	...
262,025	,,	4	4	Do. 4 p.c. Deb. ...	98—103	...
335,000	,,	5	5	Do. 5 p.c. Deb. ...	115—120	...
357,900	Feb. 21	7½	7½	Brighton, &c., 6 p.c. Con. ...	147—152*	...
649,955	,,	6½	6½	Do. 5 p.c. Con. ...	131—136*	...
205,500	,,	6	6	Do. 6 p.c. 'B' Pref.	125—130*	...
855,000	Sept. 20	8	7	British Ord.	140—145	...
100,000	Dec. 13	7	7	Do. 7 p.c. Pref.	140—145	...
350,000	,,	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	110—115	...
120,000	,,	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...
450,000	,	5	5	Do. 5 p.c. Red. Deb. ...	102—107	...
450,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100	...
100,000	22 May '33	6	4	Cape Town, Ltd.	1½—2½	...
100,000	6 Nov. '33	4½	4½	Do. 4½ p.c. Pref. ...	1½—3½	...
150,000	Dec. 13	4½	4½	Do. 4½ p.c. Deb. ...	70—75	...
626,860	Feb. 7	6	6	Cardiff Con. Ord.	120—125	...
237,860	Dec. 13	5	5	Do. 5 p.c. Red. Deb.	106—111	...
98,936	Oct. 4	2/-	2/-	Colombo Ord....	1⅞—1⅞	...
24,510	,,	1/4½	1/4½	Do. 7 p.c. Pref.	23/6—25/6	...
739,453	Oct. 4	-/11·48	-/11·48	Colonial Gas Assn. Ltd. Ord.	17/—19/—	...
296,144	,,	1/3·30	1/3·30	Do. 8 p.c. Pref.	22/—24/—	...
1,775,005	Feb. 7	5	5	Commercial Ord.	83—88	...
620,000	Nov. 29	3	3	Do. 3 p.c. Deb. ...	73—78	...
286,344	Feb. 7	5	5	Do. 5 p.c. Deb. ...	113—118	...
807,560	Feb. 21	7	7	Croydon sliding scale... ...	138—143*	...
644,590	,,	5	5	Do max. div.	107—112*	...
620,385	Dec. 13	5	5	Do. 5 p.c. Deb.	115—120	...
239,000	Feb. 7	5	5	East Hull Ord. 5 p.c.... ...	96—101	...
185,355	Feb. 21	6	6	East Surrey Ord. 5 p.c. ...	118—123*	...
176,211	Dec. 13	5	5	Do. 5 p.c. Deb. ...	112—117	...
250,000	Nov. 15	7	4	Gas Consolidation Ord. ...	19/6—21/6	...
250,000	,,	4	4	Do. 4 p.c. Red. Cum. Pref.	18/6—20/6	...
19,223,324	Feb. 7	5⅝	5⅝	Gas Light & Coke Ord. ...	23/—24/-a	—/3
2,600,000	,,	3½	3½	Do. 3½ p.c. max. ...	83—86	...
4,477,106	,,	4	4	Do. 4 p.c. Con. Pref.	100—103	...
2,993,000	Jan. 17	...	3½	Do. 3½ p.c. Red. Pref.	101½—103½	...
8,602,497	Nov. 29	3	3	Do. 3 p.c. Con. Deb.	80—83	—1
3,642,770	,,	5	5	Do. 5 p.c. Red. Deb.	113—116	...
3,500,000	,,	4½	4½	Do. 4½ p.c. Red. Deb.	111½—114½	...
700,000	Sept. 6	3½	3½	Do. 3½ p.c. Red. Deb.	98—101	...
270,466	Feb. 21	6	6	Harrogate New Cons. ...	118—123*	...
157,500	April 5	1/2⅝	1/2⅝	Hong Kong and China Ord	¾—1	...
213,200	Feb. 7	6	6	Hornsey Con. 3½ p.c. ...	133,010	...
5,600,000	Nov. 4	12	8	Imperial Continental Cap. ...	118—123	—4
223,130	Jan. 17	3½	3½	Do. 3½ p.c. Red. Deb. ...	88—93	...
285,242	Feb. 21	8½	8½	Lea Bridge 5 p.c. Ord. ...	167—172*	...
11,751	Feb. 21	8	10	Maidstone 5 p.c. Cap.... ...	175—185*	...
63,480	Dec. 13	3	3	Do. 3 p.c. Deb. ...	70—75	...
75,000	Nov. 29	†10	†10	Malta & Mediterranean ...	145—155	...
392,000	Oct. 1	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	100—103	...
231,977	Feb. 21	5	5	M.S. Utility 'C' Cons. ...	99—104*	...
968,658	,,	4	4	Do. 4 p.c. Cons. Pref.	95—100*	...
360,075	Dec. 13	4	4	M.S. Utility 4 p.c. Deb. ...	97—102	...
148,955	,,	5	5	Do. 5 p.c. Deb. ...	113—118	...
675,000	Nov. 15	†9	†6	Montevideo, Ltd.	75—80	...
250,000	Aug. 9	7½	7½	North Middlesex 6 p.c. Con.	147—152	...
396,160	Feb. 7	5	5	Northampton 5 p.c. max. ...	108—113	...
300,000	Oct. 18	†7	†9	Oriental, Ltd.	153—158	...
468,537	Dec. 13	8	8	Plymouth & Stonehouse 5 p.c.	154—159	...
621,667	Feb. 7	8½	8½	Portsmouth & Gosport Cons.	161—166	...
241,446	,,	5	5	Do. 5 p.c. max. ...	102—107	...
73,350	,,	5	5	Do. 5 p.c. Pref. ...	108—113	...
247,966	Dec. 13	4	4	Primitiva 4 p.c. Cons. Deb. ...	98—103	...
625,959	Jan. 17	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...
15,000	Sept. 6	6	6	San Paulo 6 p.c. Cum. Pref. ...	9—9½	...
441,275	Sept. 20	1/1½	1/1½	Severn Val. Gas Cor. Ld. Ord.	21/—23/-	—/6
460,810	,,	-/10½	-/10½	,, ,, 4½ p.c. Cum. Pref.	19/6—21/6	...
133,201	Feb. 7	8½	5	Shrewsbury 5 p.c. Ord. ...	128—133	...
9,000	June 7	4	4	South African Ord.	3⅜—4⅜	...
1,371,752	Sept. 6	1/2⅜	1/2⅜	South East'n Gas Cn. Ld. Ord.	23/—25/-	...
871,636	,,	-/10½	-/10½	Do. 4½ p.c. Red. Cum. Pref.	20/—22/—	...
498,818	,,	4	4	Do. 4 p.c. Cum. Pref. ...	18/—20/-	...
450,000	Feb. 7	4	4	Do. 4 p.c. Deb.	98—101	...
150,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—98	...
6,709,895	Feb. 7	6	5	South Met. Ord.	105—108	—1
1,135,812	,,	6	6	Do. 6 p.c. Irred. Pf. ...	130—135	...
850,000	,,	4	4	Do. 4 p.c. Irred. Pf. ...	97—100	...
1,895,445	Dec. 13	3	3	Do. 3 p.c. Deb. ...	78—81	+1
1,000,000	Jan. 17	5	5	Do. 5 p.c. Red. Deb....	109—112	...
1,543,795	Feb. 7	6	6	South Suburban Ord. 5 p.c. ...	118—123	...
512,825	,,	5	5	Do. 5 p.c. Pref....	110—115	...
500,000	,,	4	4	Do. 4 p.c. Pref....	95—100	...
250,000	,,	§18/9	3⅜	Do. 3⅜ p.c. Red. Pref.	98—101	...
888,587	Dec. 13	5	5	Do. 5 p.c. Deb....	115—120	...
250,000	,,	4	4	Do. 4 p.c. Deb....	97—100	...
200,000	Sept. 20	...	3½	Do. 3½ p.c. Red. Deb.	94—99	...
427,859	Nov. 1	1/2½	9⅜	S. Western Gas & Water Ord.	18/6—20/6	...
160,523	,,	-/10½	-/10½	Do. 4½ p.c. Red. Cum. Pf.	19/6—21/6	...
110,000	Dec. 13	4	4	Do. 4 p.c. Red. Deb. ...	97—102	...
750,541	Feb. 7	5	5⅓	Southampton Ord. 5 p.c. ...	109—114	...
148,836	Dec. 13	4	4	Do. 4 p.c. Deb.	96—101	...
350,000	Feb. 7	5½	5½	Swansea 5½ p.c. Red. Pref. ...	108—113	...
94,000	Jan. 3	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100	...
1,076,490	Feb. 7	6½	6½	Tottenham and District Ord.	128—133	...
409,835	,,	5½	5½	Do. 5½ p.c. Pref....	119—124	...
62,235	,,	5	5	Do. 5 p.c. Pref....	108—113	...
371,850	Dec. 13	4	4	Do. 4 p.c. Deb....	97—102	...
85,701	July 19	‡6	6	Tuscan 6 p.c. Red. Deb. ...	96—101	...
888,629	Oct. 4	6	4	U. Kingdom Gas Cor. Ord....	19/—21/-	...
937,743	Nov. 15	4½	4½	Do. 4½ p.c. 1st Cum. Pref.	20/—22/—	...
500,000	,,	...	-/1·15	Do. 4 p.c. 1st Red. Cum. Pf.	19/—21/-	...
745,263	Dec. 13	4½	4½	Do. 4½ p.c. 2nd Non-Cum.Pf.	16/6—18/6	...
1,000,000	Sept. 20	3½	3½	Do. 3½ p.c. Red. Deb. ...	96—99	...
373,939	Feb. 7	7	7	Uxbridge, &c., 5 p.c.	136—141	...
133,010	,,	5	5	Do. 5 p.c. Pref. ...	108—113	...
1,371,138	Feb. 7	7	7	Wandsworth Consolidated ...	137—142	—1
2,525,768	,,	4	4	Do. 4 p.c. Pref. ...	96—101	...
1,343,964	Dec. 13	5	5	Do. 5 p.c. Deb. ...	115—120	...
383,745	,,	4	4	Do. 4 p.c. Deb. ...	97—102	...
558,342	Feb. 7	7	7	Watford and St. Albans Ord.	137—142	—1
200,000	,,	5	5	Do. 5 p.c. Pref. ...	110—115	+2
200,000	,,	5½	5½	Do. 5½ p.c Pref. ...	120—125	+1
200,000	Nov. 29	4	4	Do. 4 p.c. Red. Deb.	97—102	+2
100,000	,,	3⅜	3⅜	Do. 3⅜ p.c. Red. Deb.	95—100	+1

a.—The quotation is per £1 of stock. * Ex. div. † Paid free of income-tax ‡ For year. § Actual.

Supplementary List and Provincial Exchanges overleaf.

STOCK AND SHARE LIST—Cont.

Supplementary List, not Officially Quoted, London

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Mar. 4.	Rise or Fall on Week.
202,152	Sept. 6	25/–b	5	Ascot Ord.	105—110	...
128,182	Dec. 13	5	5	Do. 5 p.c. Pref.	108—113	...
31,035	Aug. 23	...	-/4½	Associated Utilities 4 p.c. Pref.	16/6—18/6	...
100,000	Dec. 13	...	3½	Do. 3½ p.c. Red. Deb....	95—100	...
17,000	Feb. 21	8	8	Bognor Orig. Ord. 'A' ...	157—167*	...
62,210	,,	8	8	Do. New Addl. 'A' ...	157—167*	...
87,160	,,	7	7	Do. New 7 p.c. max. ...	138—143*	...
37,440	Feb. 7	10	10	Cam. Univ. & Town 10 p.c. max.	190—200	...
125,970	,,	7	7	Do. 7 p.c. max.	135—140	...
39,025	,,	5	5	Do. 5 p.c. max.	97—102	...
96,410	Feb. 7	4½	4½	Cardiff 4½ p.c. Pref.	95—100	...
150,000	Feb. 21	4	4	Croydon 4 p.c. Pref.	97—101*	...
130,000	Dec. 13	4	4	Do. 4 p.c. Deb.	97—102	...
65,000	Aug. 9	8½	7½	Eastbourne 'A' 5 p.c. ...	158—163	...
198,000	,,	7	6	Do. 'B' 3½ p.c.	128—133	...
112,312	,,	5	5	Do. 5 p.c. Pref.	108—113	...
130,000	Dec. 13	5	5	Do. 5 p.c. Deb.	113—118	...
24,000	Feb. 21	8½	8½	Great Yarmouth 8½ p.c. max.	43—48*	...
59,400	,,	7½	7½	Do. 7½ p.c. max.	33—38*	...
51,160	Dec. 13	5½	5½	Do. 5½ p.c. Deb.	120—125	...
152,600	Feb. 21	8	9	Guildford Cons.	167—172*	...
54,055	,,	5	5	Do. 5 p.c. Pref.	108—113*	...
68,250	Dec. 13	5	5	Do. 5 p.c. Deb.	112—117	...
156,600	Feb. 21	7¼	7¼	Hampton Court Cons. ...	142—152*	...
80,000	Feb. 21	4	4	Lea Bridge 4 p.c. Pref ...	94—99*	...
60,000	,,	6	6	Do. 6 p.c. Pref. ...	123—128*	...
94,876	Dec. 13	4	4	Do. 4 p.c. Deb. ...	97—100	...
73,620	Sept. 6	8¾	8¾	Luton Cons. 'A'	163—168	...
107,960	Sept. 20	5½	4	Mid Kent Ord.	8¾—9¼	...
230,940	Feb. 7	10	10	Oxford & District Ord. ...	202—207	...
47,112	,,	5	5	Do. 5 p.c. Pref.	106—111	...
50,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	108—113	...
126,193	Nov. 15	7½	7½	Peterborough Ord.	158—163	...
64,990	Sept. 6	7½	6½	Redditch Ord....	125—135	...
166,850	Feb. 7	8	8	Romford Ord....	148—153	...
60,000	,,	4	4	Do. 4 p.c. Pref.	97—100	...
44,000	Sept. 20	5	5	Do. 5 p.c. Deb.	113—118	...
25,570	Feb. 7	5½	5½	Rugby 5½ p.c. Pref. ...	123—128	...
25,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	103—108	...
42,750	Dec. 13	5½	5½	Do. 5½ p.c. Deb.	120—125	...
10,950	Feb. 21	8	8	Ryde Ord.	140—150*	-7½
270,086	Sept. 6	7	7	Slough Ord.	133—138	...
21,000	Dec. 13	5	5	Do. 5 p.c. Deb.	110—115	...
28,872	Nov. 1	5½	5½	S. Midland Gas Cpn. Ltd. Ord.	19/—21/–	...
28,866	Sept. 6	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	18/6—20/6	...
137,730	Feb. 21	7	7	Southgate & Dist. 7 p.c. max.	138—143*	...
62,500	,,	5	5	Do. 5 p.c. Pref.	110—115*	...
117,228	Feb. 7	5	5	Swindon Cons.	104—109	...
60,425	Dec. 13	5	5	Do. 5 p.c. Deb.	110—115	...
64,380	Dec. 13	5	5	Torquay and Paignton 5 p.c. Pf.	108—113	...
33,858	Nov. 15	...	-/2·70c	United Kingdom Gas Corpn. 4½ p.c. 1st Cum. Pref. ...	20/—22/–	...
130,000	Feb. 7	5	8	Wakefield Ord.	118—123	...
81,650	,,	5	5	Do. 5 p.c. max.	101—106	...
82,000	Feb. 21	6	6	Weymouth Ord.	110—115	...
98,384	Feb. 7	6	6	Wolverhampton 6 p.c. Pref....	118—123	...
160,000	Dec. 13	5½	5½	Do. 5½ p.c. Rd. Db.	107—112	...
90,000	Dec. 13	5	5	York 5 p.c. Red. Deb.... ...	104—109	...
133,640	Feb. 21	6½	6½	Yorktown (Cam.) 5 p.c. Cons.	126—131*	...
120,000	,,	5	5	Do. 5 p.c. Pref.	106—111*	...
35,000	Dec. 13	5½	5½	Do. 5½ p.c. Deb.	121—126	...

BRISTOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations, Mar. 4.	Rise or Fall on Week.
347,756	Feb. 7	5	6	Bath Cons.	118—120	...
1,667,250	Feb. 7	5	5	Bristol, 5 p.c. max.	118—119	...
120,420	Dec. 13	4	4	Do. 1st 4 p.c. Deb. ...	100—102	...
217,870	,,	4	4	Do. 2nd 4 p.c. Deb. ...	100—102	...
328,790	,,	5	5	Do. 5 p.c. Deb.	119—122	...
274,000	Feb. 21	5	5	Newport (Mon.) 5 p.c. max....	99—101*	+1
13,200	Sept. 6	8	7	Pontyp'l Gas & W. 10 p.c. 'A'	13—14	...
13,600	,,	6	5	Do. 7 p.c. 'B'	11⅞—12⅞	...
40,000	,,	6	5	Do. 7 p.c. 'C'	11⅞—12⅞	...
140,778	Feb. 7	5	5	Weston-super-Mare Cons. ...	110—112	...
64,338	Jan. 3	4	4	Do. 4 p.c. Deb.	94½—96½	...
33,340	,,	7⅛	7⅛	Do. 7⅛ p.c. Deb.	154—157	...

LIVERPOOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations, Mar. 4.	Rise or Fall on Week.
157,150	Feb. 7	5	6½	Chester 5 p.c. Ord.	103½—107½	...
92,500	Dec. 13	4	4	Do. 4 p.c. Pref.	96—100	...
36,430	,,	3½	3½	Do. 3½ p.c. Deb.... ...	88—91	...
41,890	,,	4	4	Do. 4 p.c. Red. Deb. ...	97—101	...
2,167,410	Feb. 21	6	6	Liverpool 5 p.c. Ord.... ...	123—124*	...
245,500	Dec. 13	5	5	Do. 5 p.c. Red. Pref. ...	99—104	...
306,083	Jan. 17	4	4	Do. 4 p.c. Deb. ...	100—102	...
106,280	Feb. 7	10	10	Preston 'A' 10 p.c.	202—212	...
188,219	,,	7	7	Do. 'B' 7 p.c.	144—154	...

NEWCASTLE EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations, Mar. 4.	Rise or Fall on Week.
122,577	Feb. 21	8	8	Blyth 5 p.c. Ord.	163½—164½*	...
732,000	Feb. 21	5	5	Hartlepool G. & W. Cn. & New	110—112*	...
2,061,315	Feb. 7	5	5⅔	Newcastle & Gateshead Con.	22/9—23/3a	-/3
682,856	,,	4	4	Do. 4 p.c. Pref. ...	97½—98½	...
776,706	Jan. 3	3½	3½	Do. 3½ p.c. Deb. ...	89½—90½	...
277,285	Nov. 1	5	5	Do. 5 p.c. Deb. '43...	103—105	...
332,351	Feb. 7	6	6	Sunderland 6 p.c. max. ...	137—139	...

NOTTINGHAM EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations, Mar. 4.	Rise or Fall on Week.
542,270	Feb. 21	6	9	Derby Con.	135—145*	...
55,000	Dec. 13	4	4	Do. 4 p.c. Deb. ...	100—105	...
20,000	Dec. 13	5	5	Long Eaton 5 p.c. Pref. ...	10—12	...
80,000	,,	5	5	Do. 5 p.c. Deb. ...	105—110	...

SHEFFIELD EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations, Mar. 4.	Rise or Fall on Week.
10,000	Feb. 21	10	10	Great Grimsby 'A' Ord. ...	210—220*	...
6,500	,,	10	10	Do. 'B' Ord. ...	210—220*	...
79,000	,,	10	10	Do. 'C' Ord. ...	205—210*	...
1,806,339	Feb. 21	6½	6½	Sheffield Cons.	142—145*	...
95,000	Jan. 3	4	4	Do. 4 p.c. Deb.	100—103	...

a The quotation is per £1 of Stock. § Actual for Quarter. c Actual. * Ex div.

PUBLISHERS' NOTICE

TERMS OF SUBSCRIPTION

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